Animal Welfare Institute
900 Pennsylvania Avenue, SE, Washington, DC 20003

May 24, 2022

Dr. Gail Golab
Dr. Cia Johnson
Panel on Animal Depopulation
American Veterinary Medical Association
1931 North Meacham Road, Suite 100
Schaumburg, IL 60173-4360

Dear Dr. Golab, Dr. Johnson, and the Panel on the Depopulation of Animals:

I am writing to follow-up on previous letters I submitted on behalf of the Animal Welfare Institute (AWI) regarding ventilation shutdown plus and other methods of depopulation.[1,2,3] I am also writing as a long-time member of the AVMA, and as a practicing veterinarian who counts chickens and pigs among her patients.

AWI aims to share new research, analysis, and information for incorporation into the deliberations of the Panel on Animal Depopulation (Panel) about potential revisions to the *AVMA Guidelines for the Depopulation of Animals* (*Guidelines*). We also encourage the AVMA to consider this information in its discourse around the veterinary profession's role in preventing and preparing for animal depopulations, decreasing their scale, and mitigating negative impacts on animal welfare.

Methods of Ventilation Shutdown

Ventilation Shutdown Plus Carbon Dioxide (VSD+CO_2)

In our October 2021 letter, we noted that the method of VSD+CO_2 has been little studied and that the *Guidelines* do not clearly explain how VSD+CO_2 differs from whole house gassing (WHG) with carbon dioxide (CO_2). We discussed that in both cases, the ventilation system of a barn would be sealed and carbon dioxide introduced. We pointed out that, while several studies have been carried out on

[1] Liss, C. & Reyes-Illg, G. (2021, October). *Animal Welfare Institute to José Arce and AVMA Panel on Animal Depopulation* [Letter]. https://awionline.org/sites/default/files/uploads/documents/AWI-Letter-AVMA-Depopulation-Panel-Oct-2021.pdf
[2] AWI. (2021. October 27). *AVMA Urged to Revise Guidelines to Prevent Mass Killing of Farm Animals by Heat Stroke* [Press Release]. https://awionline.org/press-releases/avma-urged-revise-guidelines-prevent-mass-killing-farm-animals-heat-stroke
[3] Reyes-Illg, G. & Reynolds, J. (2022, January). *Animal Welfare Institute to José Arce and AVMA Panel on Animal Depopulation* [Letter]. https://awionline.org/sites/default/files/uploads/documents/Letter-to-AVMA-on-VSD-Research-Studies.pdf

whole house gassing in a commercial setting,[4,5,6] the only research performed on a method referred to as VSD+CO_2 was carried out under laboratory conditions and involved the slow introduction of CO_2 such that time to death took 1.5 hours, or four times as long as what is reported for WHG.[7,8] Videos recorded during this research depict birds displaying signs of respiratory distress for a prolonged period.[9]

In WHG, introduction of carbon dioxide into a barn typically causes a significant drop in temperature (up to -112˚F [-80˚C] at the site of release) if not pre-warmed.[10] Even when liquid CO_2 is pre-warmed to enter a gaseous stage prior to entering the building, it is only warmed only to a maximum of 77˚F (25˚C), so the temperature in the poultry house does not increase above the thermal comfort zone. VSD alone typically causes death via heatstroke, a mechanism of killing that the addition of CO_2 precludes, according to Dr. Scott Beutelschies, an Emergency Coordinator for USDA APHIS.[11] Thus, it seems that in both VSD+CO_2 and WHG with CO_2, hypercapnic hypoxia would be the cause of death and the literature to date fails to identify any difference between the two methods other than the speed with which CO_2 is introduced.

Furthermore, while USDA APHIS provides a protocol and best practices for WHG with CO_2, includes WHG units in the National Veterinary Stockpile, and trains Veterinary Services depopulation leads on use of this method,[12] this is not the case for VSD+CO_2. Recently, I submitted an inquiry to the U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) regarding the definition of VSD+CO_2, the difference between VSD+CO_2 and WHG, and whether VSD+ has ever been used (included here as Attachment 1). In APHIS's response, which is included here as Attachment 2, Deputy Administrator of APHIS Veterinary Services Dr. Rosemary Sifford replied:

> "While VSD+ carbon dioxide (VSD+CO_2) is a potential depopulation method, at this point, it is a theoretical but not yet practical option for U.S. producers."

---

[4] McKeegan, D. E., Sparks, N. H., Sandilands, V., Demmers, T. G., Boulcott, P., & Wathes, C. M. (2011). Physiological responses of laying hens during whole-house killing with carbon dioxide. *British poultry science*, *52*(6), 645–657. https://doi.org/10.1080/00071668.2011.640307

[5] Turner, P. V., Kloeze, H., Dam, A., Ward, D., Leung, N., Brown, E. E., Whiteman, A., Chiappetta, M. E., & Hunter, D. B. (2012). Mass depopulation of laying hens in whole barns with liquid carbon dioxide: evaluation of welfare impact. *Poultry science*, *91*(7), 1558–1568. https://doi.org/10.3382/ps.2012-02139

[6] EFSA Panel on Animal Health and Welfare (AHAW), Nielsen, S. S., Alvarez, J., Bicout, D. J., Calistri, *et al*. (2019). Killing for purposes other than slaughter: poultry. EFSA journal. European Food Safety Authority, 17(11), e05850. Pp. 24-25. https://doi.org/10.2903/j.efsa.2019.5850

[7] Anderson K., Livingston K., Shah S., et al. (2017, March 30). *Evaluating hen behavior and physiological stressors during VSD for the development of humane methodologies for mass depopulation during a disease outbreak. Final report*. Project BRU007. Tucker, Ga: US Poultry and Egg Association, 2017.

[8] Eberle-Krish, K.N., Martin, M. P., Malheiros, R. D., Shah, S. B., Livingston, K. A., & Anderson, K. E. (2018). Evaluation of Ventilation Shutdown in a Multi-level Caged System. *Journal of Applied Poultry Research*, *27*(4), 555–563. https://doi.org/10.3382/japr/pfy036

[9] Videos available at: https://drive.google.com/drive/folders/1Ocvpj6kcc1w-oHEw6yQUHs2DkK-WbzT7. All four videos in the "VSD Video 7" and "VSD Video 9" folders depict trials with individual birds undergoing VSD+CO_2

[10] EFSA Panel on Animal Health and Welfare (AHAW), Nielsen, S. S., Alvarez, J., Bicout, D. J., Calistri, *et al*. (2019). Killing for purposes other than slaughter: poultry. EFSA journal. European Food Safety Authority, 17(11), e05850. Pp. 24-25. https://doi.org/10.2903/j.efsa.2019.5850

[11] Beutelschies, S. USDAAPHIS. (2017, Oct. 12). *NVS Development of CO2 Whole House Gassing for Emergency Depopulation of Poultry* [Video]. YouTube. https://www.youtube.com/watch?v=TKM_yKFovj4

[12] *Ibid.*

Dr. Sifford did not respond to the part of the inquiry related to the differences between WHG with CO_2 and VSD+CO_2. We suspect this may be because the AVMA's depopulation guidelines fail to address this question.

In the interest of clarifying the animal welfare concerns of various depopulation methods, we recommend that the *Guidelines* remove any references to VSD+CO_2 and clarify that all forms of killing by filling a whole barn with CO_2 will be referred to as Whole House Gassing. This will ensure that those tasked with managing depopulations are able to access relevant information and research, and that discussions about the animal welfare impacts of depopulation methods are not muddled by grouping methods with disparate mechanisms of killing (hypercapnic hypoxia v. heatstroke) into the same category.

Ventilation Shutdown Plus Heat +/- Humidity

Mechanism of death

The *Guidelines* currently identify hyperthermia as the cause of death when poultry are subjected to VSD or VSD+Heat. However, regarding the cause of death when ventilation systems in swine facilities fail, the *Guidelines* state, "In realistic terms, death may result from any combination of excessive temperature, CO2, or toxic gases from slurry or manure below the barn." The *Guidelines* imply that all of these factors may also be mechanisms of killing when VSD or VSD+Heat are used as depopulation methods. In our October 2022 letter, we noted that all available research indicates that heatstroke is the cause of death for VSD alone, VSD+Heat, and VSD+Heat & Humidity.[13,14,15,16] In all available studies on these methods, oxygen levels never become low enough to cause or hasten death, nor does carbon dioxide rise to lethal levels.

As such, it is important that revisions to the *Guidelines* accurately identify heatstroke as the mechanism of killing for these three methods. The Panel also has an obligation to take into consideration the severe and prolonged suffering that is known to accompany heatstroke when making decisions about the classification of these methods.

Earlier this year, the organization Animal Outlook received through a public records request videos associated with the research the Panel previously used to justify inclusion of VSD+ in the 2019 *Guidelines*.[17] (AWI included critiques of this research in our October 2021 letter.) While behavioral animal welfare indicators were not specifically studied by the investigators, this raw video footage could certainly be used by veterinary animal welfare specialists to assess the impact on animal welfare of

---

[13] Eberle-Krish, K.N., Martin, M. P., Malheiros, R. D., Shah, S. B., Livingston, K. A., & Anderson, K. E. (2018). Evaluation of Ventilation Shutdown in a Multi-level Caged System. *Journal of Applied Poultry Research*, *27*(4), 555–563. https://doi.org/10.3382/japr/pfy036

[14] Zhao, Y., Xin, H., & Li, L. (2019). Modelling and validating the indoor environment and supplemental heat requirement during ventilation shutdown (VSD) for rapid depopulation of hens and turkeys. *Biosystems Engineering*, *184*, 130–141. https://doi.org/10.1016/j.biosystemseng.2019.06.014

[15] Baysinger, A., Senn, M., Gebhardt, J., Rademacher, C., & Pairis-Garcia, M. (2021). A case study of ventilation shutdown with the addition of high temperature and humidity for depopulation of pigs. *Journal of the American Veterinary Medical Association*, *259*(4), 415–424. https://doi.org/10.2460/javma.259.4.415

[16] Anderson K., Livingston K., Shah S., et al. (2017, March 30). *Evaluating hen behavior and physiological stressors during VSD for the development of humane methodologies for mass depopulation during a disease outbreak. Final report*. Project BRU007. Tucker, Ga: US Poultry and Egg Association, 2017.

[17] *Ibid.*

VSD+Heat. The videos show single birds in experimental cages being exposed to various forms of VSD. The birds show a high level of distress, including open mouth breathing, tachypnea, flailing, escape attempts, and vocalizations.[18]

In evaluating animal welfare and duration of suffering, it is important to consider that the deaths recorded on the videos were significantly faster than deaths under commercial conditions. While VSD+Heat reportedly took an average 3,202 seconds (53.4 minutes) to kill the chickens depicted in the videos, the animals took longer to die (1.5 hours) in Phase 3 of this research project, when a chamber meant to replicate commercial conditions was constructed. Under commercial conditions, research indicates that some birds take up to 4.5 hours (16,200 seconds) to die, and there is evidence that a portion of them actually survive (see below).

Compliance with mortality criteria

The *Guidelines* provide criteria for the use of Ventilation Shutdown Plus in constrained circumstances for both pigs and poultry. Recently, new analysis and evidence has come to light that indicates that VSD+ fails to meet these criteria. This provides additional reasons for the Panel to reclassify VSD+Heat+/-Humidity as "not recommended."

For pigs, the *Guidelines* state, "The POD recommends that VSD only be used in facilities with the capability to adequately increase air temperature to a level that causes the generation of latent heat that results in a > 95% death rate in < 1 hour. The goal of any depopulation is 100% mortality, and this remains true for VSD."

Our October 2021 letter argued that the only published study on the use of VSD+Heat+Humidity yielded results that did not conform to this standard due to the fact that, once ventilation was shut down and heat began to be introduced, it took an average of 90.4 minutes for nursery pigs to become silent (and presumably deceased or dying) and 110.3 minutes for finishing pigs; in one case, for over 2.5 hours was required.[19] In response to this critique, the study authors replied:[20]

> "Given that this case report documented VSD+TH [Ventilation Shutdown with Temperature and Humidity], time 0 was defined once all elements (temperature and humidity) of the method were applied."

---

[18] Videos available at: https://drive.google.com/drive/folders/1Ocvpj6kcc1w-oHEw6yQUHs2DkK-WbzT7. The following videos depict VSD+Heat:
- **VSD Videos 5**: all 5 videos
- **VSD Videos 6**: all 7 videos, though only 5 depict the bird in the chamber
- **VSD Videos 8**: 7 of the videos, as indicated by "VH" in title (VSD- Camera 2 VH 1-21-16 (1), VSD- Camera 2 VH 1-21-16 (2), VSD- Camera 2b VH 2-3-16 (1), VSD- Camera 2b VH 2-3-16 (2), VSD- Camera 2b VH 2-3-16 (3), VSD- Camera 2b VH 2-3-16 (4), VSD- Camera 2b VH 2-3-16 (5)

[19] Baysinger, A., Senn, M., Gebhardt, J., Rademacher, C., & Pairis-Garcia, M. (2021). A case study of ventilation shutdown with the addition of high temperature and humidity for depopulation of pigs. *Journal of the American Veterinary Medical Association*, *259*(4), 415–424. https://doi.org/10.2460/javma.259.4.415

[20] Baysinger, A., Senn, M., Gebhardt, J., Rademacher, C., & Pairis-Garcia, M. (2021). Author's response [Reply to Letters to the Editor]. *Journal of the American Veterinary Medical Association*, 259(10), 1103-1104. https://doi.org/10.2460/javma.259.10.1102. Full text available at: https://www.vin.com/apputil/image/handler.ashx?docid=10673892

This did not dispel concerns about animal welfare, which was undoubtedly compromised prior to time 0, given that the barn temperature rose at least 50 degrees Fahrenheit (28 degrees Celsius) from the normal temperatures range of 50-80˚F (10-26.7˚C) to the "time 0" temperature of 130˚F (54˚C).

A recent study evaluating water-based medium-expansion foam as a method of porcine depopulation discusses ventilation shutdown plus heat and humidity.[21] These authors, veterinarians and animal scientists from the Ohio State University, reached a similar conclusion to ours:

> "One case study was generated during the mass depopulation of approximately 250,000 swine (nursery and finisher sizes) by VSD+ at a farm in Iowa, during the early months of the SARS-CoV-2 pandemic. The results indicated that this method was not able to reach 95% death rate in less than the one-hour limit for VSD+, per AVMA Depopulation Guidelines. The inability to reach targeted death rate within the desired timeframe occurred despite extensive modifications to the barn, including the addition of steam and heat in the absence of ventilation."

This provides additional support for revision of the *Guidelines* to reclassify both VSD+Heat and VSD+Heat+Humidity as "not recommended," based on its own previously stated criteria.

Similarly, newly available information indicates that VSD+Heat also fails to meet the criteria set forth in the *Guidelines* for use in poultry. To meet the classification category "permitted in constrained circumstances," the *Guidelines* require that VSD+Heat be "applied in a manner that will produce a 100% mortality rate." While the *Guidelines* do not provide a firm time limit to reach 100% mortality, they recommend raising the temperature to 104°F within 30 minutes and maintaining it between 104°F and 110°F for a minimum of three hours, suggesting a time limit of 3.5 hours to achieve 100% mortality.

Recently, an Iowa egg production facility called Rembrandt Farms depopulated 5.3 million hens using VSD+Heat.[22] Activists from the group Direct Action Everywhere (DxE) covertly entered the property after the depopulation and found numerous surviving hens. The organization reported that they found more than 100 hens still alive in the buildings they entered; extrapolating this to the parts of the facility they did not enter would suggest several hundred surviving chickens.[23] Video footage released by DxE shows 12 live hens, in cages, loose in depopulated barns, and sitting atop a pile of composting carcasses.[24]

---

[21] Kieffer, J. D., Campler, M. R., Cheng, T. Y., Arruda, A. G., Youngblood, B., Moeller, S. J., & Bowman, A. S. (2022). Evaluation of a Water-Based Medium-Expansion Foam Depopulation Method in Suckling and Finisher Pigs. *Animals: an open access journal from MDPI*, *12*(8), 1041. https://doi.org/10.3390/ani12081041

[22] Cullen, T. (2022, March 23). Five million layers snuffed as avian flu hits – Rembrandt Enterprises down with virus. *Storm Lake Times*. https://www.stormlake.com/articles/five-million-layers-snuffed-as-avian-flu-hits/

[23] Torrella, K. (2022, May 5). The horrific bird flu that has wiped out 36 million chickens and turkeys, explained. *Vox*. https://www.vox.com/future-perfect/23053296/bird-flu-chickens-turkeys-cull-depopulation-ventilation-shutdown

[24] DxE. (2022, March 23). Key Clips. https://www.dropbox.com/sh/q913qy6rhwnhdoz/AABMtyCARdDu3fXd4bXBzZWta/Key%20Clips?dl=0&subfolder_nav_tracking=1 Titles of video clips of surviving birds: Lethargic Birds in Cages, Live birds left for dead and dead:compost pile, Live chickens running loose in depopulated shed, Walking up to chicken in cage, and Walking up to dead bird then showing live lethargic bird in nearby cage

The finding that some hens routinely survive VSD+Heat is also indicated by recent documents obtained via public records request. Approximately 220,000 broiler chickens in 11 barns were depopulated via VSD+Heat in Kentucky in February (see Attachment 7). The state veterinarian reports that a Tyson veterinarian informed her that birds on the edges of the barns were expected to survive. The veterinarian indicated that Tyson did not intend to start killing these survivors (via cervical dislocation) until about 8 hours or longer after the VSD+Heat procedure had concluded. The number of heatstroke survivors was not given, but additional records received by AWI (see Attachment 5), indicate that there were survivors, as cervical dislocation is listed among the methods of depopulation used at this facility.

For a number of reasons, achieving 100% mortality is important with any method of euthanasia or depopulation. With infectious disease situations, surviving animals can continue to spread disease. With regard to animal welfare, surviving VSD+Heat results in an animal who (1) continues to suffer from the disease process or physical harm incurred by nonfatal heatstroke (as seems likely with some of the hens in the DxE videos), (2) dies slowly of dehydration, starvation, or exposure to the elements (as was likely the case for the alert and responsive hens in the DxE videos), and/or (3) is buried or composted alive among millions of carcasses. Because there is a relatively long period of time between the start of VSD+ and the opportunity to assess for survivors, the negative impact on animal welfare is even greater than for other, more rapid depopulation methods.

At this stage, the only published research on VSD or VSD+ to depopulate poultry has failed to assess mortality rate under commercial conditions. Only one study has been published on use of VSD+Heat under commercial conditions and neither animal welfare nor mortality rate were specifically evaluated.[25] A single paragraph in the report addressed bird behavior and latency to "lie down," a behavior that suggests a weakened, moribund, or deceased condition. This study also demonstrates a morality rate of <100% when the *Guidelines*' recommendations are followed, based on percentage of birds standing 3.5 hours after the ventilation system was shut down and heat began to be introduced:

> "Bird behaviours were visually observed through a surveillance system installed inside the breeder room. Many breeders migrated in the early stage of VSD, possibly seeking for cool areas. The breeders started lying down at 2:15 h into VSD. At 3:00 h into VSD, 95% of the breeders lied down. The VSD validation test in the breeder house eventually lasted for approximately 4.5 h as a small portion (est. <1%) of breeders remained standing/alive at 3.5 h into the VSD process."

Given the dearth of mortality-focused studies on the commercial use of VSD+ on poultry, we encourage the Panel to review this study and the videographic evidence provided by DxE. Together, they provide reason for the Panel to change the classification for VSD+Heat to "not recommended" on the grounds that the method fails to achieve minimal requirements for both animal welfare consideration and controlling disease dissemination.

---

[25] Zhao, Y., Xin, H., & Li, L. (2019). Modelling and validating the indoor environment and supplemental heat requirement during ventilation shutdown (VSD) for rapid depopulation of hens and turkeys. *Biosystems Engineering*, *184*, 130–141. https://doi.org/10.1016/j.biosystemseng.2019.06.014

Foaming Methods

In their current form, the *Guidelines* do not discuss or give recommendations regarding nitrogen gas-filled high-expansion foam, a method considered by many to be more humane than the medium-expansion water-based, air-filled foam classified in the *Guidelines* as "preferred" for floor- or aviary-reared confined poultry.[26] The European Food Safety Authority's *Killing for Purposes Other Than Slaughter: Poultry* notes that the dense fire-fighting foam being used in the U.S. on the recommendation of the Panel has a high water content and occludes the airways, so animals are killed by suffocation and/or drowning, neither of which are generally considered humane.[27]

In contrast, nitrogen gas-filled, high-expansion foam has a large bubble size and low water content (expansion ratio between 250:1 and >350:1). Research carried out over nearly two decades indicate that, when this method is carried out correctly under appropriate environmental conditions, low oxygen content (<1%) leads to rapid loss of consciousness and death by anoxia when used in poultry and pigs. When the foam is made with sufficiently low water content and large enough bubbles, anoxia due to nitrogen gas inhalation, rather than airway occlusion, is the mechanism of killing. This method also has a lower environmental impact that some other depopulation methods, as it does not release carbon dioxide and uses less water than foams with lower expansion ratios. Attachment 3 contains a list of research articles regarding nitrogen-infused high-expansion foam which we request be reviewed by the Panel as it deliberates regarding revision of the *Guidelines*.

Versions of this method, including containerized and whole-barn methods, are now commercially available in Europe for use in pigs and poultry. In addition, multiple companies are interested in bringing the technology to the U.S.[28,29,30] Livetec, based in the United Kingdom, has undertaken trials of its commercial nitrogen foam delivery system in partnership with the National Pork Board and the Minnesota Agricultural Department, [31,32,33] while High Expansion Foam Technology (HEFT), based in Sweden, is working with the University of Minnesota College of Veterinary Medicine on containerized methods that may be reengineered for a whole barn setting.[34] In developing its whole-barn nitrogen foaming technology, HEFT has plans for foam infused with disinfectants that could further limit disease spread. We encourage the Panel to incorporate the expertise of Harm Kiezebrink and Julian Sparrey, the researchers developing commercial adaptations of this method.

---

[26] Humane Slaughter Association. (n.d). Gaseous Methods. https://www.hsa.org.uk/gaseous-methods/gaseous-methods

[27] EFSA Panel on Animal Health and Welfare (AHAW), Nielsen, S. S., Alvarez, J., Bicout, D. J., Calistri, P., Depner, *et al*. (2019). Killing for purposes other than slaughter: poultry. *EFSA journal. European Food Safety Authority*, *17*(11), e05850. https://doi.org/10.2903/j.efsa.2019.5850

[28] HEFT International. (n.d.). HEFT Emergency Response. https://heftinternational.com/emergency-response/

[29] N2GF. (n.d.) The Anoxia Technique. http://n2gf.com/

[30] Williams, T. (2022, March 30). Validation and Demonstration of Utilizing High Expansion Nitrogen Foam for Large Scale Depopulation of Swine, NPB Project #21-069.

[31] *Ibid.*

[32] Livetec. (2021, August 18). Livetec: More than just a depopulation service. https://www.livetecsystems.co.uk/livetec-systems-more-than-just-a-depopulation-service/

[33] Livetec. (2022). Nitrogen Foam Delivery System Product Guide. https://www.livetecsystems.co.uk/wp-content/uploads/2022/04/Livetec_NFDS_ProductGuide-UK.pdf

[34] H. Kiezebrink of HEFT, personal communication, May 11, 2022.

In order for producers to receive indemnity payments for a notifiable disease such as Highly Pathogenic Avian Influenza (HPAI), "depopulation must be conducted according to AVMA (2019) guidelines."[35] Unfortunately, the *Guidelines*' failure to include nitrogen gas-infused high-expansion foam has created a major disincentive for producers considering adoption of a potentially more humane depopulation method. Livetec cites the need for AVMA approval as the main challenge to adoption of this method in the United States.[36]

In revising the Guidelines, it is essential that the Panel (1) make clear the different mechanisms of achieving anoxia with different types of foam and discuss the implications for animal welfare, (2) examine in detail all available evidence for nitrogen-infused high-expansion foam, and (3) specify the minimum expansion ratio necessary to avoid airway occlusion and drowning of animals. If the Panel determines that nitrogen gas-infused foam systems are in fact a more humane and faster method of depopulation of poultry and/or pigs than is the currently used medium-expansion water-based foam, it should recommend the high expansion method as "preferred" and revise the classification of the airway-occluding method to "permitted in constrained circumstances." To the extent that all foaming methods seem to cause some distress and escape behaviors as the foam begins to cover the animals' heads, the Panel could also recommend research into means of managing animals' fear and anxiety, for example, via pre-emptive administration of anxiolytics in feed.

The Impact of Animal Housing System on Depopulations

While the *Guidelines* are primarily intended to assist those tasked with depopulation, they also acknowledge that depopulation must proceed only "when significant effort to save animals' lives has been exhausted." Moreover, the AVMA's *Principles of Animal Welfare* and *Principles of Veterinary Medical Ethics* support a leadership role for the veterinary profession in helping our society to decrease the frequency of depopulations, minimize the number of animals depopulated, and change management practices such that more humane depopulation methods are practicable and utilized. These duties are made all the more pressing by the psychological harm experienced by veterinarians and other workers involved in depopulations. If such issues are considered outside of the scope of the Panel, then the AVMA should develop another internal body to scrutinize such issues.

One key issue deserving of the AVMA's attention is the ever-increasing size of concentrated animal feeding operations (CAFOs) in the U.S. The on-going HPAI pandemic has made clear that the proliferation of extremely large CAFOs leads to: (1) greater numbers of animals being killed during depopulations, (2) the increased use of nonpreferred methods, like VSD+Heat, and (3) delays in depopulation which increase the risk and scale of continued viral transmission. Public health is endangered by mega-CAFOs through their potential to speed the evolution of zoonotic pathogens.

Because of the requirement to depopulate an entire operation when even one barn is found to be infected with HPAI, massive operations contribute disproportionately to the total number of animals depopulated. Rembrandt Enterprises, as discussed above, housed 5.3 million hens in 20 barns.[37] Just as

---

[35] APHIS. (2022, April). Emergency Response for Highly Pathogenic Avian Influenza Outbreaks in Seven States Draft Environmental Assessment, p. 36. https://www.regulations.gov/document/APHIS-2022-0031-0001

[36] D. Clegg of Livetec Systems, personal communication, October 19, 2021.

[37] Cullen, T. (2022, March 23). Five million layers snuffed as avian flu hits – Rembrandt Enterprises down with virus. *Storm Lake Times*. https://www.stormlake.com/articles/five-million-layers-snuffed-as-avian-flu-hits/

in 2015, the close proximity of barns to one another meant that all animals were required to be depopulated rapidly as soon as HPAI was detected in the flock. Through May 23rd of the current HPAI outbreak, 32 depopulations in the U.S. involved more than 100,000 birds.[38] Eleven of these involved more than 1 million birds, who accounted for over two-thirds of the total number depopulated so far.

During the current HPAI pandemic, the use of VSD+Heat to depopulate poultry increased exponentially compared to the 2015/2016 event. Despite the *Guidelines*' injunction that VSD+ be reserved as a last resort, analysis of public records provided to AWI by the USDA (see Attachment 5), show that, in February and March 2022, 73.1% of the depopulations used only VSD+Heat or VSD+Heat and at least one other method. (While figures are not yet available for April and May, there is no reason to think methods used during these months were any different.)

In February and March alone, at least 11,329,200 birds, or 77.3%, were killed via heatstroke utilizing VSD+Heat. The list provided by the USDA does not break down the number of animals killed by individual methods on operations where multiple methods were used, so the true percentage of birds killed with VSD+Heat during February and March 2022 is somewhere between 77.3% and 96.3%. Given the pain and distress involved in dying from heatstroke, these statistics likely represent a magnitude of animal suffering that is unprecedented.

The evidence available indicates that their large size and enormous animal populations is what leads large CAFOs to select VSD+Heat as their first choice of depopulation method. This is illustrated in a series of emails received by the organization Animal Outlook in response to a public records request (see Attachment 6). In an email to an APHIS official requesting approval to use VSD+Heat in Missouri, a veterinarian from Tyson explained that the facility was simply too large for foaming to be completed in time. The following excerpts are from the email chain:

> "I am requesting that we are allowed to depopulate the 12 house broiler farm in Stoddard County, Missouri through use of AVMA approved VSD+. Through our experiences and available resources, we do not feel we effectively foam such a large farm in a 24-hour period."

Another series of similarly obtained emails from Kentucky also indicate that corporate producers are requesting permission from APHIS to use VSD+Heat as a first line method, and they use the large number of birds at a facility as the justification. As depicted in Attachment 7, another veterinarian for Tyson wrote:

> "[T]his is a constrained circumstance, because it is a large farm (240,000 birds) with 12 houses. We could not possibly foam the birds in the next 72 hours."

In this instance, APHIS initially required use of foaming rather than VSD+Heat, but there was a delay in the start of foaming due to failure to supply sufficient water. APHIS then approved indemnification if VSD+Heat was used. After water became available, Tyson still elected to proceed with VSD+Heat despite foaming being accessible.

---

[38] APHIS. (2022, May 24). 2022 Confirmations of Highly Pathogenic Avian Influenza in Commercial and Backyard Flocks. https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian/avian-influenza/hpai-2022/2022-hpai-commercial-backyard-flocks

The more humane and rapid method of WHG with CO_2 is the predominant method being used in Europe during the ongoing HPAI pandemic. In 2016 and 2017, WHG with CO_2 was a focus area for APHIS Veterinary Services (see Attachments 8 and 9). However, during the current HPAI pandemic, WHG is being used little, if at all, in the U.S, despite the fact that APHIS officials have previously stated that WHG is feasible for depopulation within 24 to 48 hours if contractors and equipment are deployed as soon as a presumptive positive test result is obtained.[39] Since the 2019 *Guidelines* were released, it appears little to no effort has gone into developing the logistical network necessary to deploy WHG on a large scale.

The *Guidelines'* categorization of VSD+ as "permitted in constrained circumstances," together with USDA policy of reimbursing producers who use depopulation methods consistent with the *Guidelines*, means that the poultry and egg industries lack any incentive to stop creating the precise "constrained circumstances" in which the AVMA condones the inhumane method of VSD+Heat. With the "easy" method of VSD+Heat available to them, mega-CAFOs are taking no measures whatsoever to enable the use of more humane methods.

Furthermore, data from the 2022 HPAI pandemic indicates that large CAFO size is the top risk factor for a delay in depopulation beyond APHIS's hard deadline of 48 hours after confirmation of HPAI. Even when they use VSD+Heat, such large CAFOs are simply too big and have too many animals to depopulate in the necessary timespan. Of the 12 depopulations in February and March 2022 that involved more than 200,000 birds, eight of them exceeded 48 hours. Those eight depopulations involved a total of 11 million birds. During that period, the two largest depopulations of 2.8 million and 5.3 million birds were completed in 16 and 7 days, respectively. This shows that the large size of operations negatively impacts not just the ability to kill animals with a more humane method, it also negatively impacts the ability to limit virus transmission.

HPAI pandemics are now a regular occurrence in poultry. Given the experience gleaned from the current HPAI wave and the Covid-19 slaughterhouse shutdowns, the AVMA must acknowledge that the maintenance and proliferation of mega-CAFOs, especially for poultry, egg, and pork production, does not constitute the "responsible use" of animals championed in the AVMA's Animal Welfare Principles.[40] This is especially true for mega-CAFOs in which egg-laying hens are confined to battery cages; during HPAI outbreaks, speed and human health considerations mean that VSD+Heat is the only option aside from WHG, and the latter becomes increasingly challenging the larger the barn.

If the only way to ensure that large swaths of our patients are not routinely killed by heatstroke is to put in place restrictions on CAFO size, then core principles of veterinary medical ethics, like the duties of beneficence and nonmaleficence, require that our profession advocate for such restrictions.

In addition to reasons grounded in animal welfare and disease control considerations, global public health considerations provide additional reasons for the veterinary profession to advocate for restrictions in CAFO size. Epidemiologists concerned with zoonotic disease point to several ways that

---

[39] Beutelschies, S. USDAAPHIS. (2017, Oct. 12). *NVS Development of CO2 Whole House Gassing for Emergency Depopulation of Poultry* [Video]. YouTube. https://www.youtube.com/watch?v=TKM_yKFovj4

[40] AVMA. (n.d.). AVMA animal welfare principles. https://www.avma.org/resources-tools/avma-policies/avma-animal-welfare-principles

increasing intensification of animal agriculture, especially mega-CAFOs, increases risk of emerging infectious diseases: [41]

> "Higher densities result in higher contact rates between individuals, [and] reduce the cost of virulence, favouring more virulent pathogens. When contact rates are particularly high, a highly virulent pathogen may indeed be better able to transmit before it kills its host, compared to a situation with low contact rates that would select for milder pathogens. In addition, the low genetic diversity of specialized breeds may further facilitate the Darwinian selection of specialized pathogens."

As veterinarians, we can identify other features of large CAFOs, such as high levels of ammonia, dust, and animals experiencing high levels of physiologic stress and often pain, that are likely to increase animals' susceptibility to disease as well as the severity and spread of disease.

Rather than take the continued existence of ill-prepared mega-CAFOs as a given and excuse the use of heatstroke as a depopulation method on the grounds of necessity, the AVMA must remember its own edicts: [42,43]

> "Animals should be cared for in ways that minimize fear, pain, stress, and suffering."
>
> "Animals shall be treated with respect and dignity throughout their lives and, when necessary, provided a humane death."
>
> "[P]rocedures related to animal housing… should be continuously evaluated and when indicated, refined or replaced."
>
> "A veterinarian shall … recognize a responsibility to seek changes to laws and regulations which are contrary to the best interests of the patient and public health."

To the extent that the AVMA embraces these principles, it must critically examine the proliferation of mega-CAFOs in the U.S. and counsel against continuing this trend.

One straightforward means of doing this is for the AVMA to openly support legislation that would limit the size of CAFOs.[44] In addition, as veterinarians, we must use our Aesculapian authority to recommend difficult but essential changes to governmental agencies and industry. For example, the AVMA could recommend that APHIS amend its requirements[45] for restocking poultry facilities post-HPAI depopulation such that future HPAI outbreaks result in smaller scale depopulations that can be rapidly carried out using more humane methods. This might include requiring that larger facilities maintain on-

---

[41] Gilbert, M., Xiao, X., & Robinson, T. P. (2017). Intensifying poultry production systems and the emergence of avian influenza in China: a 'One Health/Ecohealth' epitome. *Archives of public health = Archives belges de sante publique*, *75*, 48. https://doi.org/10.1186/s13690-017-0218-4

[42] AVMA. (n.d.). AVMA animal welfare principles. https://www.avma.org/resources-tools/avma-policies/avma-animal-welfare-principles

[43] AVMA. (2019). Principles of veterinary medical ethics of the AVMA. https://www.avma.org/resources-tools/avma-policies/principles-veterinary-medical-ethics-avma

[44] Farm System Reform Act, S. 2332, 117th Cong. (2021). https://www.congress.gov/bill/117th-congress/senate-bill/2332?s=1&r=54

[45] APHIS. Highly Pathogenic Avian Influenza (HPAI) Restocking Your Poultry Flock. https://www.aphis.usda.gov/publications/animal_health/fs-hpai-restocking-your-poultry-flock.508.pdf

site the means to carry out "preferred" methods of depopulation and/or that they retrofit barns to phase out housing systems, like battery cages, that inherently limit the use of "preferred" methods.

Though legislative and regulatory changes generally proceed at a slow pace, the AVMA could make public statements calling on industry to reverse the shift toward increasingly irresponsible and unsustainable animal housing systems. Given the AVMA's expertise in Emergency Response, it could help producers prepare so that the equipment and supplies they would need for more humane depopulation methods are readily available and rapidly accessible. The AVMA could make clear that, pending the release of updated *Guidelines*, the label "veterinary-approved" is not an accurate descriptor for VSD+Heat.

While the AVMA may be concerned about the industry's ability to meet the current demand for poultry and egg products if such changes were adopted, this concern should not be a deterrent. While ensuring food security has long been considered an essential role for the veterinary profession, research shows that less than 25% of the growth in demand for animal-sourced foods is attributable to population growth; demand is increased primarily as a result of a changing consumer preferences, which are influenced by governmental and industry advertising and marketing efforts.[46] In the U.S. and many other developed countries, *over-consumption* of animal-sourced foods is far more problematic for human health than a deficiency of essential nutrients due to lack of such foods. As such, recommending science-based systemic changes in food production systems would be consistent with veterinarians' commitment to the "betterment of public health,"[47] even if they resulted in a modest decrease in U.S. meat and egg production and a shift by consumers to plant-based alternatives.

Thank you for your consideration. We would welcome the opportunity to discuss these matters further with any interested members of the Panel or AVMA Leadership.

Sincerely,

Gwendolen Reyes-Illg, DVM, MA
Veterinary Adviser
Animal Welfare Institute, Farm Animal Program

[46] Gilbert, M., Xiao, X., & Robinson, T. P. (2017). Intensifying poultry production systems and the emergence of avian influenza in China: a 'One Health/Ecohealth' epitome. *Archives of public health = Archives belges de sante publique*, *75*, 48. https://doi.org/10.1186/s13690-017-0218-4

[47] AVMA. (2019). Principles of veterinary medical ethics of the AVMA. https://www.avma.org/resources-tools/avma-policies/principles-veterinary-medical-ethics-avma

Attachments

1 – AWI Letter to USDA-VS

2 – USDA-VS Response to AWI

3 – List of References on Nitrogen-Infused High-Expansion Foam

4 – Validation and Demonstration of Utilizing High Expansion Nitrogen Foam for Large Scale Depopulation of Swine, NPB Project #21-069

5 – AWI Factsheet: Commercial Bird Depopulations for Highly Pathogenic Avian Influenza (HPAI) February – March 2022

6 – Public Records Request Documents: Email chain between Tyson and USDA APHIS VS re approval to use VSD+Heat in Missouri

7 – Public Records Request Documents: Email chain between Tyson and USDA APHIS VS re approval to use VSD+Heat in Kentucky

8 - NVS Development of C02 Whole House Gassing for Emergency Depopulation of Poultry

9 – Whole House Gas SOP

Attachment 1

AWI Letter to USDA-VS, April 2022

Questions regarding the Use of Ventilation Shutdown Plus

Gwendolen Reyes-Illg <Gwendy@awionline.org>

Fri 4/8/2022 7:29 AM

To: CustomerServiceCallCenter@usda.gov <CustomerServiceCallCenter@usda.gov>;APHISpress@usda.gov <APHISpress@usda.gov>;Hallie.Zimmers@usda.gov <Hallie.Zimmers@usda.gov>

1 attachments (697 KB)

2022 Five million layers snuffed as avian flu hits - Storm Lake Times Pilot.pdf;

Hello,

I would like to inquire regarding recent use of VSD+ for depopulations in response to HPAI.

1. Regarding the recent use of thermally-assisted ventilation shutdown to address the outbreak of highly pathogenic avian influenza (HPAI): the January 2022 APHIS "HPAI Ventilation Shutdown Plus (+) Policy" states that the USDA can grant the use of VSD+ in constrained circumstances, however six requirements must be met, the first one being "other methods are not available or will not be available in a timely manner," or within 24 to 48 hours.

   However, a recent article (attached) seems to suggest that VSD+ was selected in Iowa despite the availability, and indeed prior use, of other methods (foaming and gassing). The article indicates officials stated that VSD+ is preferred over methods such as foaming and gassing, which seems to contraindicate official APHIS policy.

   Could you please clarify for me whether APHIS is still following its Jan 2022 HPAI VSD+ policy?

2. Has VSD+CO2 ever been used, as far as the USDA/APHIS is aware?
   If so, what is the difference between VSD+CO2 and whole house gassing?
   Does the USDA/APHIS have specific definition differentiating these two methods of depopulation?
   If CO2 is available, wouldn't whole house or containerized gassing be an option, thus disqualifying VSD+ from consideration as an option for depopulation?

Thank you for your assistance.

Sincerely,

Gwendy Reyes-Illg, DVM, MA
(*she/her/hers*)
Veterinary Advisor

ANIMAL WELFARE INSTITUTE
900 Pennsylvania Avenue, SE
Washington, DC 20003
Email: gwendy@awionline.org
www.awionline.org

Attachment 2

USDA-VS Response to AWI, April 2022

United States Department of Agriculture

Marketing and Regulatory Programs

Washington, DC 20250

USDA

United States Department of Agriculture

Dr. Gwendy Reyes-Illg
Veterinary Advisor, Animal Welfare Institute
900 Pennsylvania Avenue, SE.
Washington, D.C. 20003
Gwendy@awionline.org

April 27, 2022

Dear Dr. Reyes-Illg:

Thank you for your online inquiry of April 8, 2022, asking about the recent use of ventilation shutdown plus heat (VSD+) in response to highly pathogenic avian influenza (HPAI).

We appreciate the opportunity to clarify our Agency's work to combat this devastating disease. During an HPAI outbreak, depopulating flocks within 24-48 hours is crucial. Scientific and epidemiologic studies show that conducting response activities within this window is critical to reduce the amount of virus in the environment, helping to protect nearby poultry operations from infection and limit the unnecessary loss of animals. The humane depopulation of infected birds—including acting quickly to minimize the amount of time that birds suffer the effects of the disease—is our primary goal.

Our preferred depopulation methods for poultry are water-based foam and carbon dioxide. However, in certain circumstances, these methods might not have the desired result nor result in a timely depopulation. In such instances, producers and state officials may determine VSD+ is the best option to stop virus amplification and widespread transmission. In some cases VSD+ could prove more effective and humane than a lengthier depopulation process.

While VSD+ carbon dioxide (VSD+CO_2) is a potential depopulation method, at this point, it is a theoretical but not yet practical option for U.S. producers. Protocols considering human safety and animal welfare have not been adequately developed and due to supply constraints, industrial volumes of CO_2 are not yet available in many parts of the country.

We hope this information was helpful. For more information, please visit the following web page to see more on USDA's HPAI response efforts: https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian/avian-influenza.

Sincerely,

Rosemary B. Sifford
Deputy Administrator
Veterinary Services

Attachment 3

List of References on Nitrogen-Infused, High-Expansion Foam

ATTACHMENT 3

List of References on Nitrogen-Infused High-Expansion Foam

- Raj, A. B., Smith, C., & Hickman, G. (2008). Novel method for killing poultry in houses with dry foam created using nitrogen. *The Veterinary record*, *162*(22), 722–723. https://doi.org/10.1136/vr.162.22.722

- Gerritzen, M.A., Reimert, H.G.M., Hindle, V.A., McKeegan, D.E.F., & Sparrey, J.M. (2010). Welfare assessment of gas filled foam as an agent for killing poultry, Report 399. Livestock Research Wageningen UR. https://www.researchgate.net/publication/275647993_welfare_assessment_of_gas_filled_foam_as_an_agent_for_killing_poultry

- McKeegan, D.E.F., Gerrizen, M.A., Sparrey, J.M. (2012, August). High expansion gas filled foam-a humane agent for emergency killing. *British Poultry Abstracts*, pp.2-4.

- McKeegan, D. E., Reimert, H. G., Hindle, V. A., Boulcott, P., Sparrey, J. M., Wathes, C. M., Demmers, T. G., & Gerritzen, M. A. (2013). Physiological and behavioral responses of poultry exposed to gas-filled high expansion foam. *Poultry science*, *92*(5), 1145–1154. https://doi.org/10.3382/ps.2012-02587

- Gurung, S., White, D., Archer, G., Styles, D., Zhao, D., Farnell, Y., Byrd, J., & Farnell, M. (2018). Carbon Dioxide and Nitrogen Infused Compressed Air Foam for Depopulation of Caged Laying Hens. *Animals: an open access journal from MDPI*, 8(1), 6. https://doi.org/10.3390/ani8010006 (note that this study utilized medium-expansion foam)

- McKeegan, D. (2018). Mass Depopulation. In J.A. Mench (Ed.), *Advances in Poultry Welfare* (pp. 351–372). Woodhead Publishing.

- EFSA Panel on Animal Health and Welfare (AHAW), Nielsen, S. S., Alvarez, J., Bicout, D. J., *et al*. (2019). Killing for purposes other than slaughter: poultry. *EFSA journal. European Food Safety Authority*, *17*(11), e05850. https://doi.org/10.2903/j.efsa.2019.5850

- Lindahl, C., Sindhøj, E., Brattlund Hellgren, R., Berg, C., & Wallenbeck, A. (2020). Responses of Pigs to Stunning with Nitrogen Filled High-Expansion Foam. *Animals: an open access journal from MDPI*, *10*(12), 2210. https://doi.org/10.3390/ani10122210

- EFSA Panel on Animal Health and Welfare (AHAW), Saxmose Nielsen, S., Alvarez, J., Bicout, D. J., *et al*. (2020). Welfare of pigs during killing for purposes other than slaughter. *EFSA journal. European Food Safety Authority*, *18*(7), e06195. https://doi.org/10.2903/j.efsa.2020.6195

- Wallenbeck, A., Sindhoj, E., Berg, C. & Lindahl, C. (2020). Improved pig welfare at slaughter - pigs' responses to air- or nitrogen foam. International Society for Applied Ethology Nordic Region Winter Meeting. https://www.researchgate.net/publication/338886693_Improved_pig_welfare_at_slaughter_-_pigs%27_responses_to_air-_or_nitrogen_foam

- Lorbach, J. N., Campler, M. R., Youngblood, B., Farnell, M. B., Beyene, T. J., Kieffer, J., Moeller, S. J., Arruda, A. G., & Bowman, A. S. (2021). Comparison of Gaseous and Water-Based Medium-Expansion Foam Depopulation Methods in Cull Sows. *Animals: an open access journal from MDPI*, *11*(11), 3179. https://doi.org/10.3390/ani11113179 (note that expansion ratio was not measured, so it is not clear whether foam was high- or medium-expansion)

- Miller, L., Williams, T., Pepin, B., Odland, C. (2022, Feb. 26 - March 1). *Nitrogen gas delivered by highly expanding foam for the depopulation of swine*. 53rd Annual Meeting of the American Association of Swine Veterinarians. www.aasv.org

- Williams, T. (2022, March 30). Validation and Demonstration of Utilizing High Expansion Nitrogen Foam for Large Scale Depopulation of Swine, NPB Project #21-069. (*Note: this study is included as Attachment 4 to ensure the Panel has access to it*)

Attachment 4

Validation and Demonstration of Use of Nitrogen Foam for Large Scale Depopulation of Swine, National Pork Board, March 2022

(Withheld pending public release)

Attachment 5

AWI Fact Sheet: Commercial Bird Depopulations for HPAI (Feb-Mar 2022), May 2022

Animal Welfare Institute
900 Pennsylvania Avenue, SE, Washington, DC 20003

Commercial Bird Depopulations for Highly Pathogenic Avian Influenza (HPAI)

February – March 2022

The Animal Welfare Institute has analyzed the depopulation of commercial flocks for HPAI during February and March 2022 using two sources: 1) USDA-APHIS online list of 2022 HPAI confirmations in commercial and backyard flocks.[1] This list includes HPAI confirmation date, state, county, type of production, operation release date, and the number of birds affected. 2) APHIS depopulation lists for February and March 2022 released through Freedom of Information Act.[2] These lists include state, county, type of production, virus detected, "euthanasia" method, and "euthanasia" completion date.

1. Total Number of Depopulated Flocks

Commercial flocks depopulated	Backyard flocks depopulated
52[3]	39[4]

2. Number of Commercial Depopulated Flocks by Species

Bird species	Number of flocks
Turkey meat birds	34 (65.4%)
Table egg layers	6 (11.5%)
Chicken meat birds (broilers)	6 (11.5%)
Turkey breeder hens	3 (5.8%)
Table egg pullets	3 (5.8%)

3. Number of Commercial Depopulations by Method

Method[5]	Number of depopulations
CO_2 cart or container	1 (1.9%)
CO_2 whole-house gassing only[6]	0 (0.0%)
Foam only	11 (21.2%)
Foam and other method[7] (other than VSD+ heat)	2 (3.8%)
VSD+ heat only	12 (23.1%)
VSD+ and CO_2[6]	5 (9.6%)
VSD+ heat and foam	17 (32.7%)
VSD+ heat and other method[7]	3 (5.8%)
VSD+ heat and foam and other method[7]	1 (1.9%)

4. Number of Commercial Depopulations Exceeding 48 Hours

Eight of 12 depopulations (66.7%) involving more than 200,000 birds exceeded 48 hours from time of test confirmation to completion of "euthanasia." These depopulations involved 11.1 million birds, with an average of 1.4 million birds per depopulation. The two largest depopulations of 2.8 million and 5.3 million birds were completed in 16 and 7 days, respectively.

5. Total Number of Birds Killed

Commercial flocks

14,664,700[8]

6. Number of Birds Killed by Species and Method

Bird species	Number of birds
Turkeys	
VSD+ heat	296,100 (17.9%)
VSD+ heat/foam	916,000 (55.3%)
VSD+ heat/other	22,800 (1.4%)
Foam	344,400 (20.8%)
Foam/other	77,600 (4.7%)
Egg Layers	
VSD+ heat	2,092,100 (18.6%)
VSD+ heat/CO_2[6]	7,814,700 (69.4%)
VSD+ heat/other	1,231,300 (10.9%)
CO_2 cart	120,300 (1.1%)
Broilers	
VSD+ heat	1,126,300 (64.4%)
VSD+ heat/foam	391,700 (22.4%)
VSD+ heat/foam/other	231,400 (13.2%)

7. Number of Commercial Depopulations by Size of Operation

Size of Operation	Number of depopulations
1 – 99,999	36 (69.2%)
100,000 – 499,999	10 (19.2%)
500,000 – 999,999	4 (7.7%)
1,000,000 – 4,999,999	1 (1.9%)
5,000,000+	1 (1.9%)

Notes

[1] USDA-APHIS, 2022 Confirmations of Highly Pathogenic Avian Influenza in Commercial and Backyard Flocks.
[2] APHIS FOIA Request No. 2022-APHIS-02403-F; APHIS FOIA Request No. 2022-APHIS-02981-F.
[3] APHIS website gives number as 59. Discrepancy likely due to depopulation completion date being beyond date range of FOIA request (i.e., depopulations completed in April 2022).
[4] APHIS website gives number as 43. Discrepancy likely due to depopulation completion date being beyond date range of FOIA request (i.e., depopulations completed in April 2022).
[5] For depopulations using multiple methods, USDA does not breakdown numbers of birds killed by the different methods.
[6] Some depopulations are listed as "VSD+ heat/CO2;" however, it's not known if this refers to whole-house gassing, cart/container CO2, or if this is another way of indicating VSD+. No entries cite whole-house gassing specifically.
[7] Other methods include captive bolt, manual cervical dislocation, and mechanical cervical dislocation.
[8] APHIS website gives number as 22.4 million. See notes #3 & 4 above.

Attachment 6

Public Records Request: Email Chain Between Tyson and USDA-VS re: Approval of VSD+ Heat in Missouri, Feb-Mar 2022

Whitlock, Dylan

From: Schmidt, Jean
Sent: Saturday, March 5, 2022 11:19 AM
To: Gosch, Terry L - APHIS
Cc: Strubberg, Steve
Subject: Re: Depopulation Method Request for 3/5/22

We approve of the request.

Sent from my iPhone

On Mar 5, 2022, at 11:15 AM, Gosch, Terry L - APHIS <Terry.Gosch@usda.gov> wrote:

Dr. Strubberg,
Per request below and after my conversations w/ personnel on site, I'm forwarding Tyson's request for VSD+ on any remaining barns that can't be foamed in time to complete total depopulation tonight. Please advise of yours' and the Director's position.
Thanks,
Terry
Terry L. Gosch, DVM, MPH, DACVPM
Area Veterinarian in Charge, Missouri
USDA-APHIS-VS
1715 Southridge Drive
Jefferson City, MO 65109
Office: 573-658-9850
Terry.Gosch@usda.gov

From: Gustin, Scott <Scott.Gustin@tyson.com>
Sent: Saturday, March 5, 2022 10:39 AM
To: Gosch, Terry L - APHIS <Terry.Gosch@usda.gov>
Subject: Depopulation Method Request for 3/5/22
We are requesting the approval to vsd 2-4 houses to complete depopulation on this farm. We do not believe the contractor will be able to complete the foaming job in all 6 houses in the time requirement. Additionally Strong storms will be moving into the area.
Please let us know if we are approved ASAP as time is of the essence to complete this depop.

Sent from my iPhone

On Mar 3, 2022, at 1:50 PM, Gustin, Scott <Scott.Gustin@tyson.com> wrote:

Dr. Gosch,
I am requesting that we are allowed to depopulate the 12 house broiler farm in Stoddard County, Missouri through use of AVMA approved VSD+. Through our experiences and available resources, we do not feel we effectively foam such a large farm in a 24-hour period. Some additional issues of concern include:

- Undue and lengthy exposure of a FAD virus with zoonotic potential to larger crews that are needed for foaming/herding birds.
- Two large broiler farms that are 40-44 days of age within 3.5 km of this farm that we would consider highly susceptible.
- Even with NVS foaming resources, would those contractors be adequately trained and have enough resources to depopulate this number of houses?
- We feel that with the static pressure-tightness of the facilities, bird density, and current weather conditions that we can accomplish VSD+ with greater expediency in Time of Death than foaming.
-

We thank you for consideration of this unique case and please let me know if I can provide further information. I am a licensed, accredited, and boarded poultry veterinarian and will be present for the duration of this exercise and was present at the KY event.
Regards,
Scott Gustin

Scott Gustin, DVM, MAM
Managing Director Vet Services

Tyson Foods Corporate
o(479)290-5526 c(479)427-0234
scott.gustin@tyson.com

Attachment 7

Public Records Request: Email Chain Between Tyson and USDA-VS re: Approval of VSD+ Heat in Kentucky, Feb 2022

Flynn, Katie (AGR)

From: Custer, Koren M - APHIS <koren.m.custer@usda.gov>
Sent: Saturday, February 12, 2022 8:25 PM
To: Meek, Dallas W - APHIS
Cc: Flynn, Katie (AGR); Sifford, Rosemary B - APHIS; Dijab, Adis - APHIS
Subject: RE: VSD+Heat

Good evening Dallas,

Veterinary Services will not be approving Dr. McCarter's request for utilization of VSD+ as the depopulation method for this flock.

As we discussed, the National Veterinary Stockpile is in the process of standing up mobilization of foaming equipment and contract crews to operate this equipment. An arrival ETA for these assets, assuming NVSL confirmation, will be provided as soon as it is available.

Thank you,
Koren

Koren Moore Custer, DVM, MPH
Director, District 1
USDA APHIS Veterinary Services
Field Operations
p: 919-855-7708
c: 774-276-1985
koren.m.custer@usda.gov
920 Main Campus Dr., Raleigh, NC 27606

From: Meek, Dallas W - APHIS <dallas.w.meek@usda.gov>
Sent: Saturday, February 12, 2022 5:59 PM
To: Custer, Koren M - APHIS <koren.m.custer@usda.gov>
Cc: Katie.flynn@ky.gov
Subject: FW: VSD+Heat

Hi Koren,

Here is the request and justification for VSD+ depopulation method from Tyson. Dr. Flynn has it as well. Please distribute as appropriate for review and consideration.

Let us know if you need further input from KY.

Thanks,

Dallas W. Meek DVM
USDA APHIS VS KY - AVIC
105 Corporate Drive, Suite H

Frankfort, KY 40601
Office: 502-848-2042
Cell: 502-682-5826

From: McCarter, Steve <steve.mccarter@tyson.com>
Sent: Saturday, February 12, 2022 5:47 PM
To: Meek, Dallas W - APHIS <dallas.w.meek@usda.gov>
Cc: Katie.flynn@ky.gov; steve.mccarter@tyson.com; Joyner, Shane <shane.joyner@tyson.com>; scott.gustin@tyson.com
Subject: VSD+Heat

Dr. Meek,

Due to emergency situation with HPAI of Asian origin and risk to the poultry industry in the US, we are requesting to use VSD + heat for depopulation of the index case in KY. First, this is a constrained circumstance, because it is a large farm (240,000 birds) with 12 houses. We could not possibly foam the birds in the next 72 hours. Second, we are concerned about our Tyson employees. We do not want them exposed to this virus due to zoonotic potential. Finally, we are concerned about the spread of this disease to other flocks. The longer the virus circulates in our birds, the more "chicken adapted" it becomes. This makes it a threat to the entire US Poultry Industry. If we bring people from all over the us and equipment, we could spread this deadly disease.

Thank you for consideration of our request. We appreciate your assistance in this emergency situation.

Sincerely,

Steve McCarter DVM

Flynn, Katie (AGR)

From: Sifford, Rosemary B - APHIS <rosemary.sifford@usda.gov>
Sent: Monday, February 14, 2022 6:12 PM
To: Custer, Koren M - APHIS; Flynn, Katie (AGR)
Cc: Dijab, Adis - APHIS; Huddleston, Alan R - APHIS; Naugle, Alecia L - APHIS
Subject: RE: VSD+Heat

Drs. Flynn and Custer,

USDA APHIS has evaluated the information about the situation at the positive broiler flock in Fulton County. Given the most recent information about the challenges with foaming and the ability of VSD+ to be used successfully in these barns, we have reached the conclusion that we will pay indemnity for the birds in this flock. The State Veterinarian and the company can approve the use of VSD+ As a method of depopulation without impacting the payment of indemnity by USDA APHIS.

Rosemary B Sifford, DVM
Deputy Administrator
Chief Veterinary Officer
Veterinary Services
USDA, APHIS

From: Custer, Koren M - APHIS <koren.m.custer@usda.gov>
Sent: Monday, February 14, 2022 5:51 PM
To: Sifford, Rosemary B - APHIS <rosemary.sifford@usda.gov>; Naugle, Alecia L - APHIS <alecia.l.naugle@usda.gov>
Cc: Dijab, Adis - APHIS <adis.dijab@usda.gov>; Huddleston, Alan R - APHIS <alan.r.huddleston@usda.gov>
Subject: FW: VSD+Heat

Hi Drs. Sifford and Naugle,

Here is the request for the utilization of VSD+ heat from the Fulton 01 company. As of right now, we have no estimate for the completion of foam depopulation by the NVS contract crews due to the issues previously identified.

Koren

USDA
Koren Moore Custer, DVM, MPH
Director, District 1
USDA APHIS Veterinary Services
Field Operations
p: 919-855-7708
c: 774-276-1985
koren.m.custer@usda.gov
920 Main Campus Dr., Raleigh, NC 27606

EXHIBIT
X

Flynn, Katie (AGR)

From: Custer, Koren M - APHIS <koren.m.custer@usda.gov>
Sent: Monday, February 14, 2022 6:31 PM
To: Craig, Christopher J - APHIS; Graham, William M - APHIS; Bolton, Shawn M - APHIS; Mayes, Michael - MRP-APHIS, Raleigh, NC
Cc: Flynn, Katie (AGR); Samantha.Beaty@tn.gov; Meek, Dallas W - APHIS; Krause, Keary M - APHIS; Kornreich, Michael A - APHIS; Mitchell, Shane (AGR)
Subject: Re: Fulton 01 Water Issues

Hi Craig,

It is a non-issue now. VSD plus is being utilized to depopulate these barns.

Thank you for working the prior issue. If I am misunderstanding the company's intent to depopulate all barns with VSD plus, please let me know.

Get Outlook for iOS

From: Craig, Christopher J - APHIS <christopher.j.craig@usda.gov>
Sent: Monday, February 14, 2022 6:14:00 PM
To: Custer, Koren M - APHIS <koren.m.custer@usda.gov>; Graham, William M - APHIS <billy.m.graham@usda.gov>; Bolton, Shawn M - APHIS <shawn.m.bolton@usda.gov>; Mayes, Michael - MRP-APHIS, Raleigh, NC <Michael.Mayes@usda.gov>
Cc: Katie.flynn@ky.gov <Katie.flynn@ky.gov>; Samantha.Beaty@tn.gov <Samantha.Beaty@tn.gov>; Meek, Dallas W - APHIS <dallas.w.meek@usda.gov>; Krause, Keary M - APHIS <keary.m.krause@usda.gov>; Kornreich, Michael A - APHIS <michael.a.kornreich@usda.gov>; Shane.Mitchell@ky.gov <Shane.Mitchell@ky.gov>
Subject: RE: Fulton 01 Water Issues

I came to the ICP to meet with the emergency manager and Tina Banet. Got everyone on calls with Mike Mays and I *think* we have it worked out.

For tonight (Monday) night. They have 2 pools full and the Tyson tanker full on site, which they think is enough for 2 barns and I think we have a plan for morning. However, I've talked to Leslie Cmach and there are still a lot of problems. The contract crew have had water for quite a while but they still haven't started foaming. She indicated that there are now a lot of birds that have been penned all day and are starting to smother.

Let me know if I can help in some way and what advice I should give Leslie.

Chris

From: Custer, Koren M - APHIS <koren.m.custer@usda.gov>
Sent: Monday, February 14, 2022 5:37 PM
To: Graham, William M - APHIS <billy.m.graham@usda.gov>; Bolton, Shawn M - APHIS <shawn.m.bolton@usda.gov>; Mayes, Michael - MRP-APHIS, Raleigh, NC <Michael.Mayes@usda.gov>
Cc: Katie.flynn@ky.gov; Samantha.Beaty@tn.gov; Meek, Dallas W - APHIS <dallas.w.meek@usda.gov>; Krause, Keary M - APHIS <keary.m.krause@usda.gov>; Kornreich, Michael A - APHIS <michael.a.kornreich@usda.gov>; Craig, Christopher J - APHIS <christopher.j.craig@usda.gov>; Shane.Mitchell@ky.gov
Subject: Fulton 01 Water Issues

Hi Billy and Shawn,

When you arrive on scene (if you haven't already), please coordinate with Mike Mayes on water issues. They need assistance identifying clean water to foam depopulate Fulton 01.

Thanks,
Koren

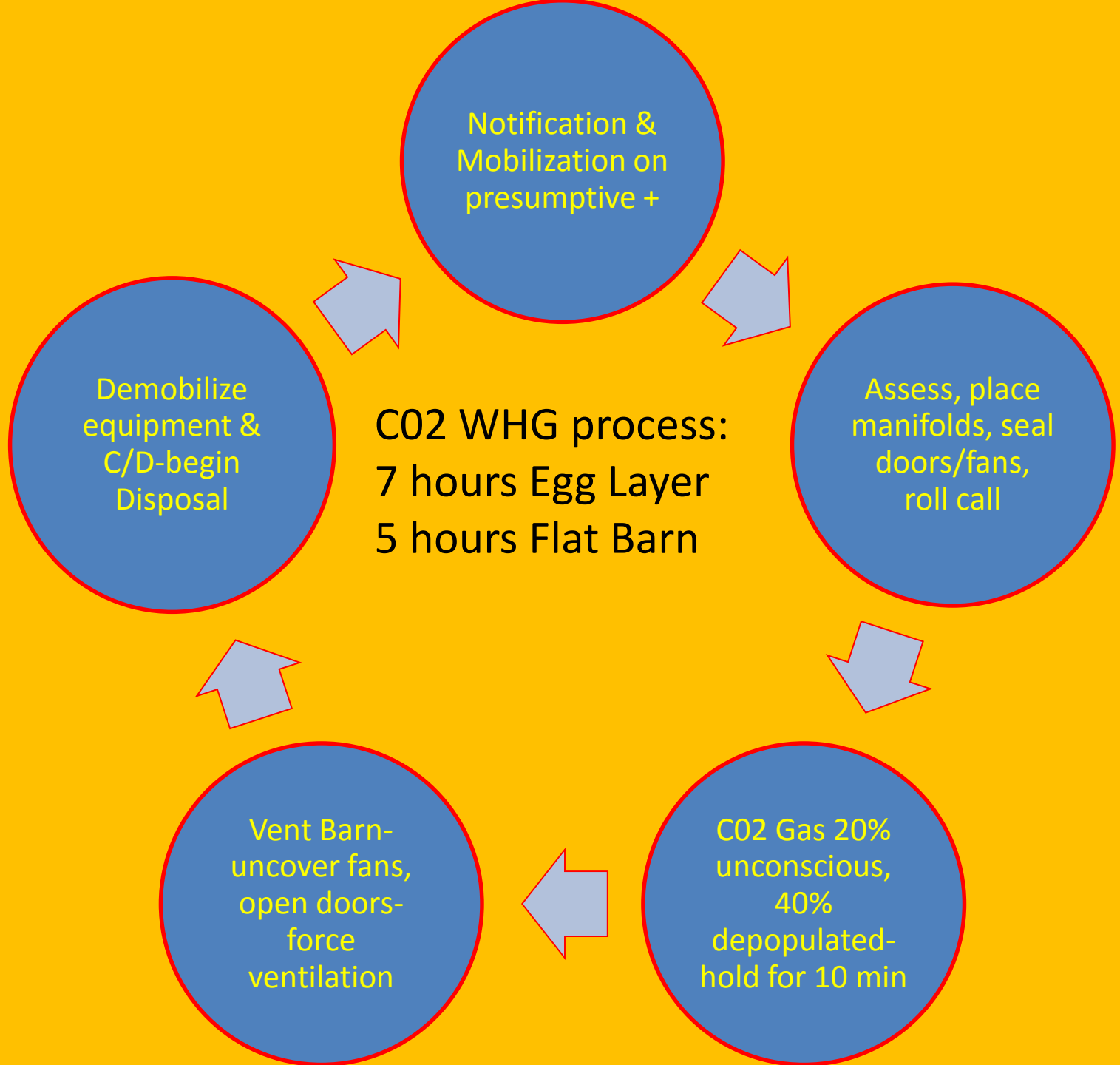
Koren Moore Custer, DVM, MPH
Director, District 1
USDA APHIS Veterinary Services
Field Operations
p: 919-855-7708
c: 774-276-1985
koren.m.custer@usda.gov
920 Main Campus Dr., Raleigh, NC 27606

Attachment 8

NVS Development of CO_2 Whole House Gassing for Emergency Depopulation of Poultry (no date)

NVS Development of C02 Whole House Gassing for Emergency Depopulation of Poultry

Dr. Scott Beutelschies
Emergency Coordinator D6 CA/HI
Scott.A.Beutelschies@aphis.usda.gov
916-206-8143


Notification & Mobilization on presumptive +
Assess, place manifolds, seal doors/fans, roll call
C02 Gas 20% unconscious, 40% depopulated- hold for 10 min
Vent Barn- uncover fans, open doors- force ventilation
Demobilize equipment & C/D-begin Disposal
C02 WHG process:
7 hours Egg Layer
5 hours Flat Barn

Units & supplies are shipped in Utility Trailers

1 C02 WHG Unit =

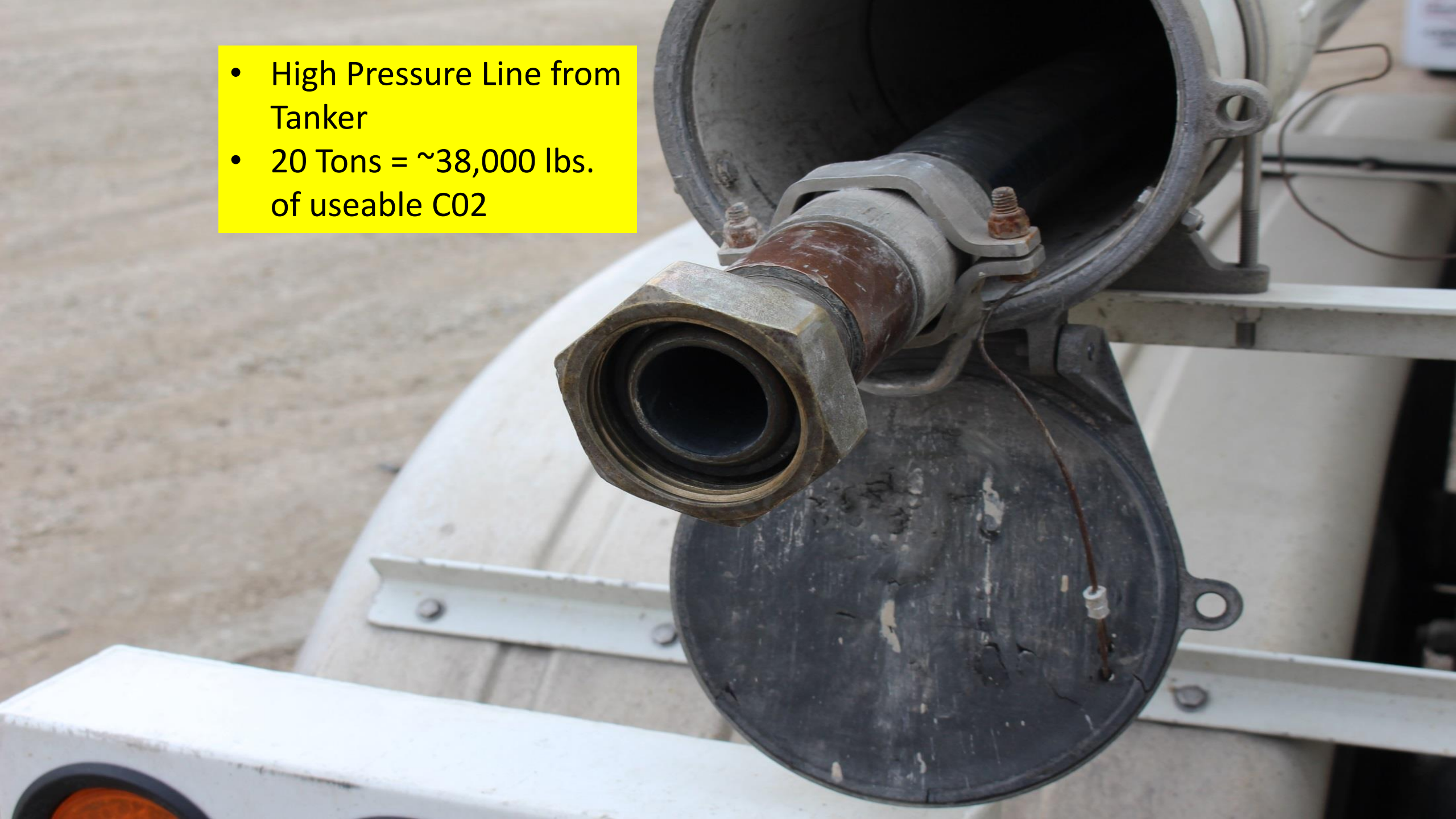
- (1) C02 tanker-20 ton & liquid high pressure line + vapor line
- (1) Distribution Box
- (4) Dosing Manifolds & 50 ft. hoses
- (4) Eagle Monitoring Devices (C02, NH3, 02) & polyethylene tubing
- Calibration station and gas cylinders for monitors
- Sealing equipment

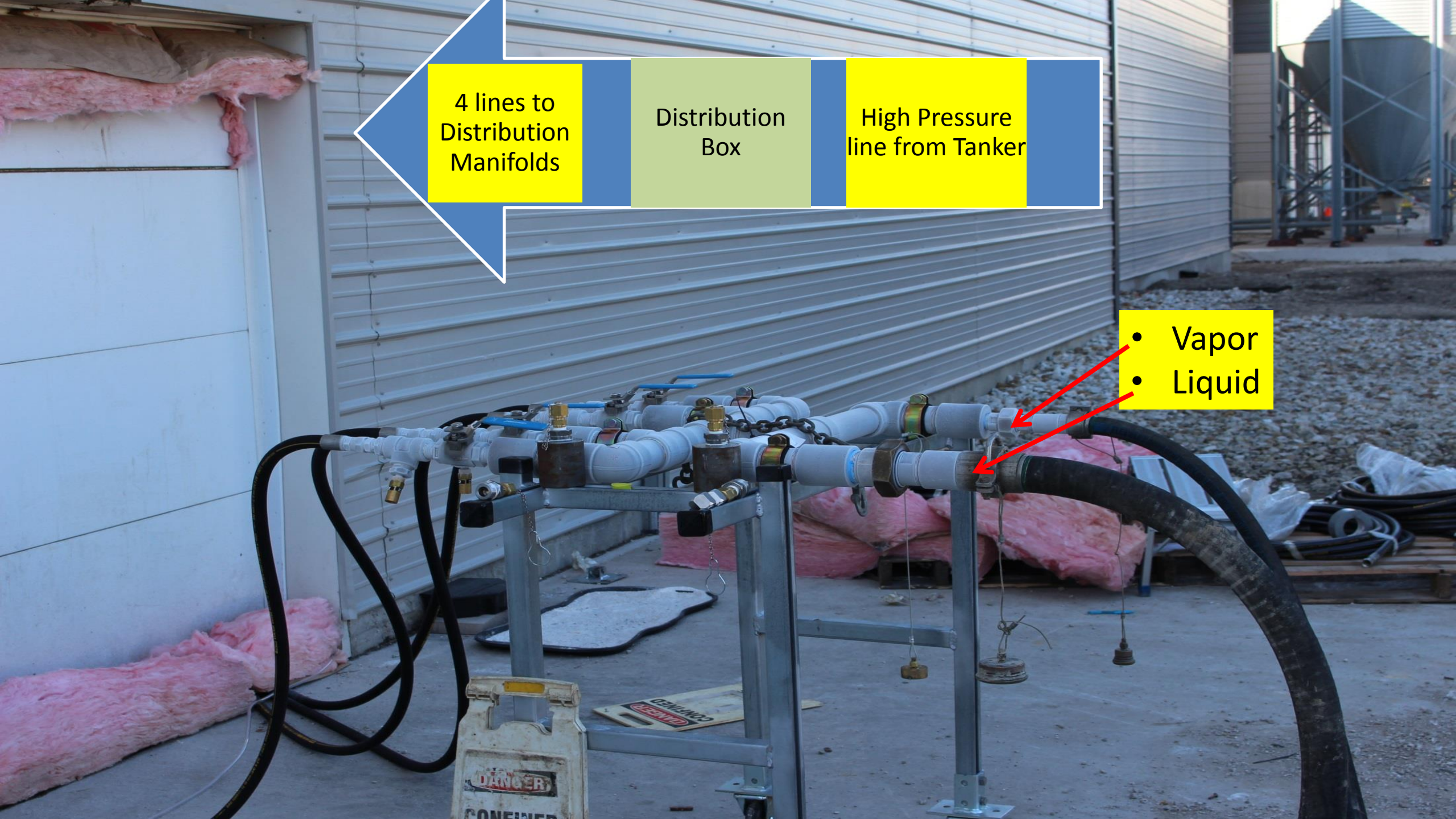
Pre-visit Day Before or key information from local responders onsite

Barn Depopulation Checklist

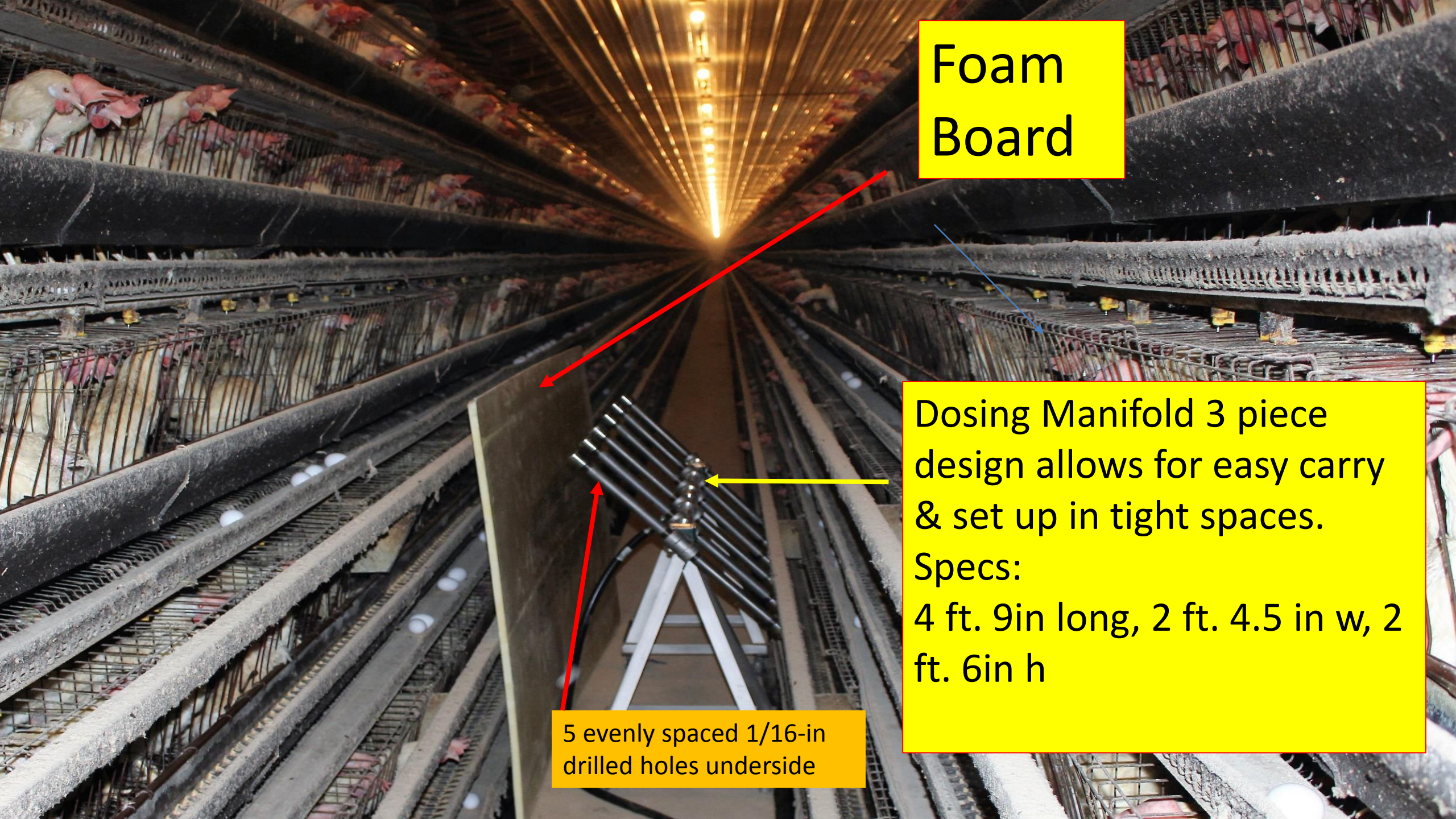
- Type of Barn/Volume/C02 estimate
- Species
- Ventilation options
- Sealing considerations
- Access for Tankers-confirm connections match
- Belts/Water pipes/freezing considerations-more time
- Special materials-insulation boards, foam, batting
- Plan for C02/02 monitoring
- Safety concerns-falling, residences, leakage to adjacent buildings


10BE
PRAXAIR
2187
2
CARBON DIOXIDE
REFRIGERATED LIQUID
WARNING
59-268
CAUTION


• High Pressure Line from Tanker
• 20 Tons = ~38,000 lbs. of useable C02

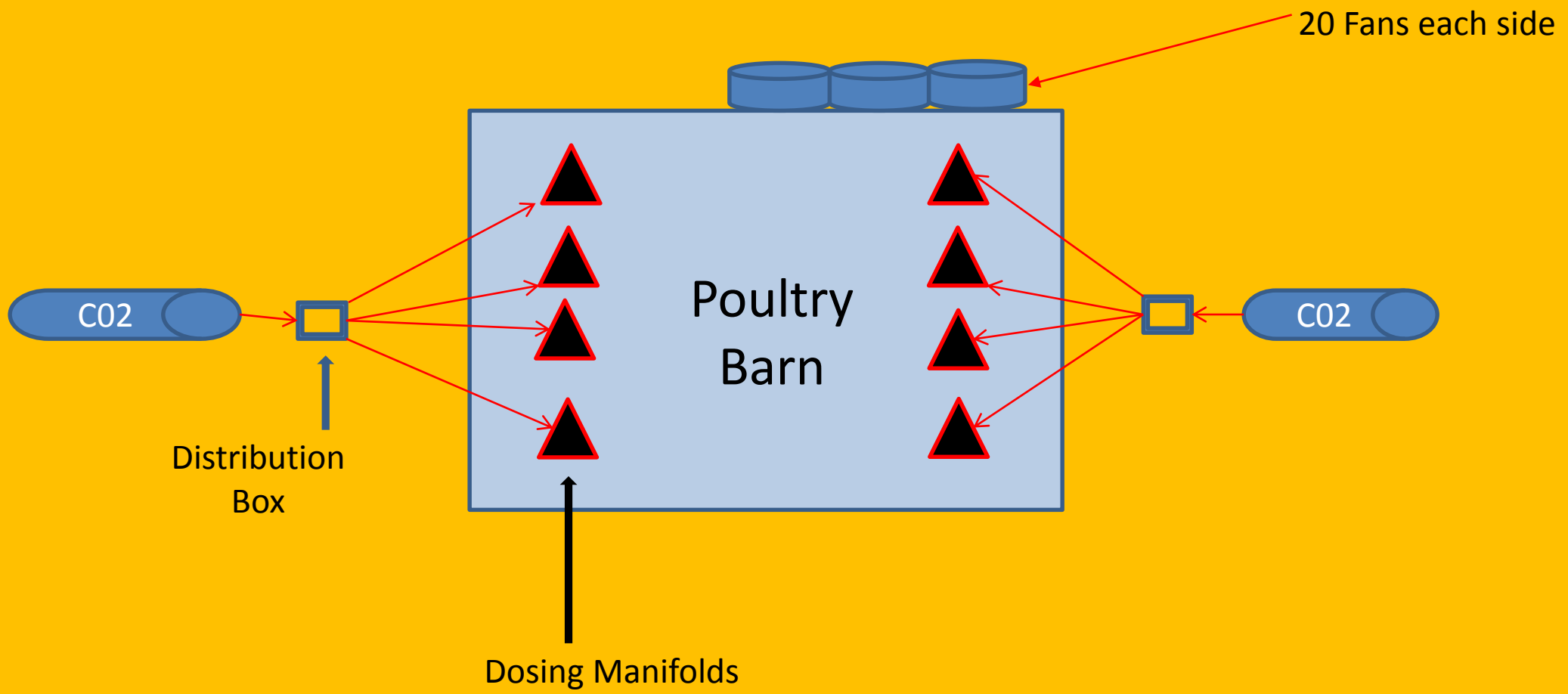

4 lines to Distribution Manifolds
Distribution Box
High Pressure line from Tanker
Vapor
Liquid
DANGER
CONFINED
DANGER


Setting up Dosing Manifolds at End of rows & attaching 50 ft. lines from Distribution Box. Do not exceed 200 ft.


Foam Board
Dosing Manifold 3 piece design allows for easy carry & set up in tight spaces.
Specs:
4 ft. 9in long, 2 ft. 4.5 in w, 2 ft. 6in h
5 evenly spaced 1/16-in drilled holes underside

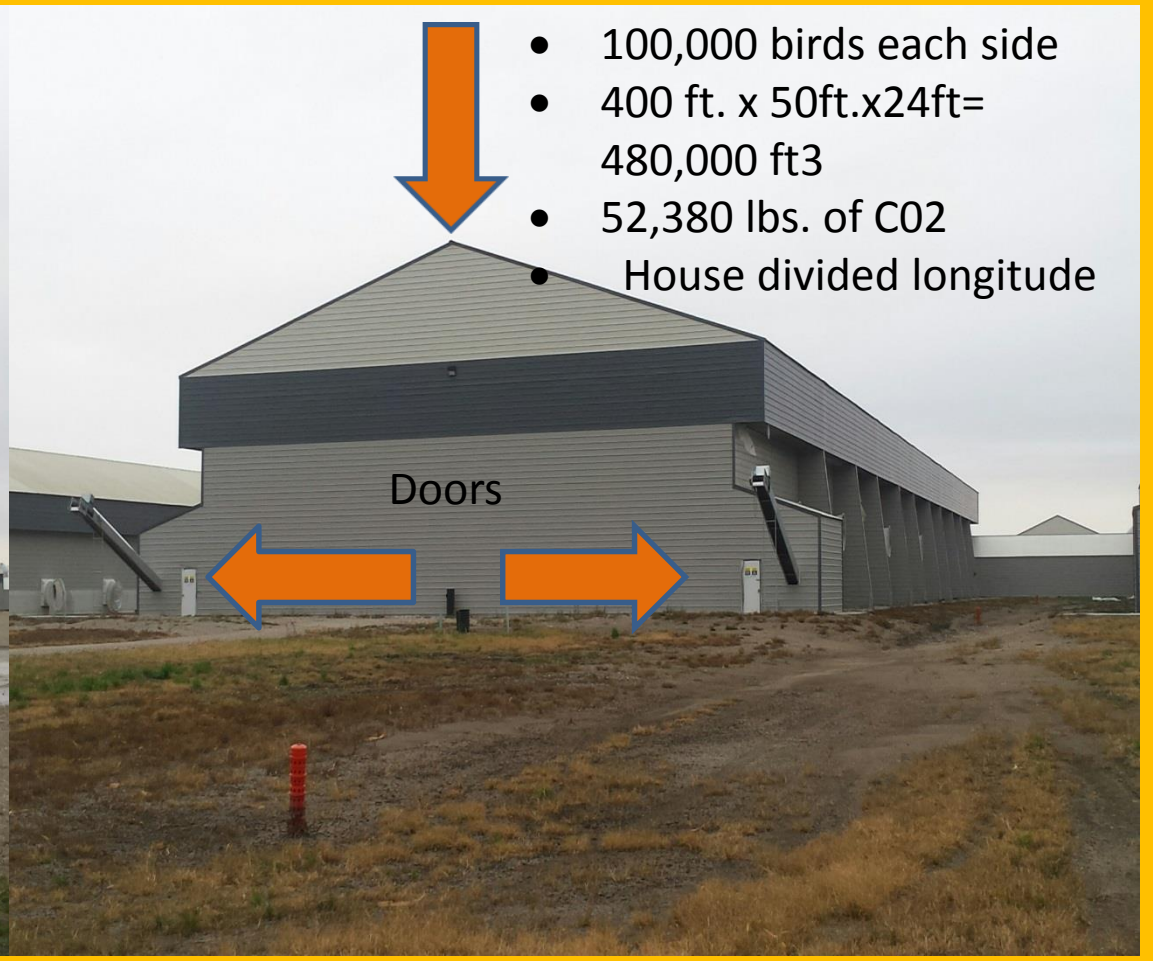
- Polyethylene tubing
- 15 in. Wrenches
- Connectors
- 50 ft. hose
- Duct Tape

Schematic of Egg Layer manifold set up



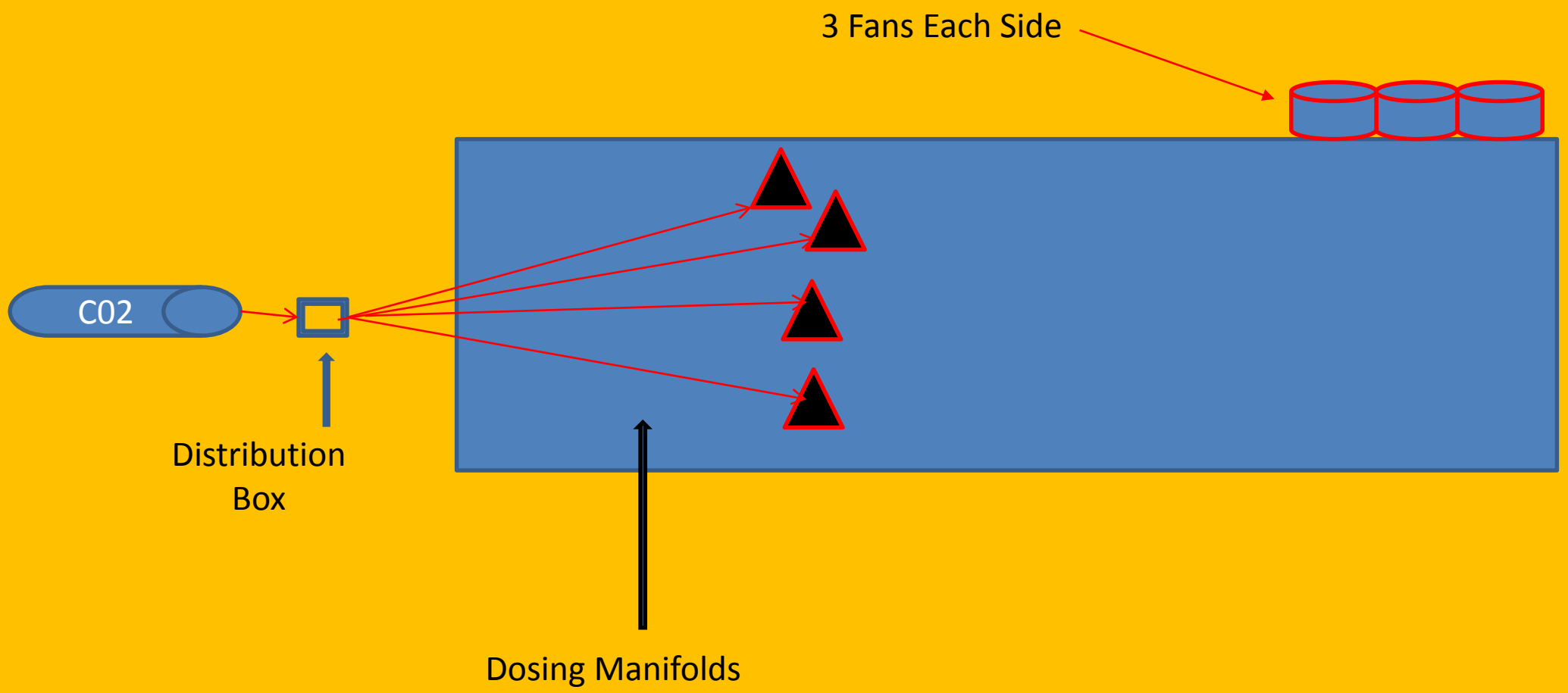
Conventional vs Enriched Barns

- ~150,000 birds
- 580 ft. X 65 ft. x 17 ft. =640,900 ft3
- 69,938 lbs. of C02



- 100,000 birds each side
- 400 ft. x 50ft.x24ft= 480,000 ft3
- 52,380 lbs. of C02
- House divided longitude

Schematic of Flat Barn manifold set up



Flat Barns curtain sided:

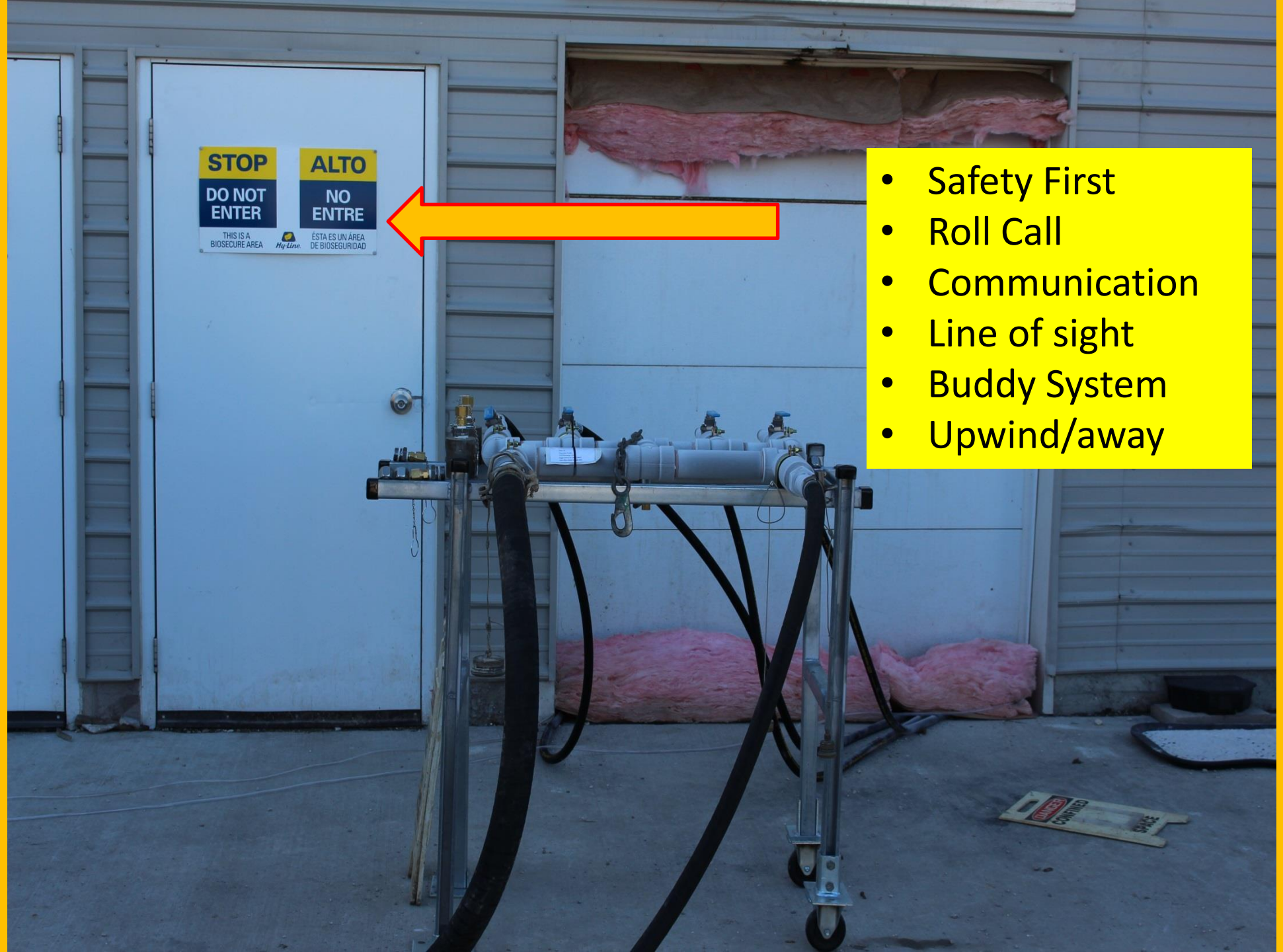
- 410 ft. X40 ft. x 3ft. = 49,200 cubic feet /8.9 =5,528 estimated lbs. of C02
- C02 estimate is low- 8,000-12, 000 lbs./house has been documented for similar dimensions
- 6,000 to 8,000 birds/barn

Comparison of Sealing Options

Traditional Egg Layer-note pallet bands

Flat Barn-note duct tape

C02/02 Monitoring Tubing High/Low each end & egg room



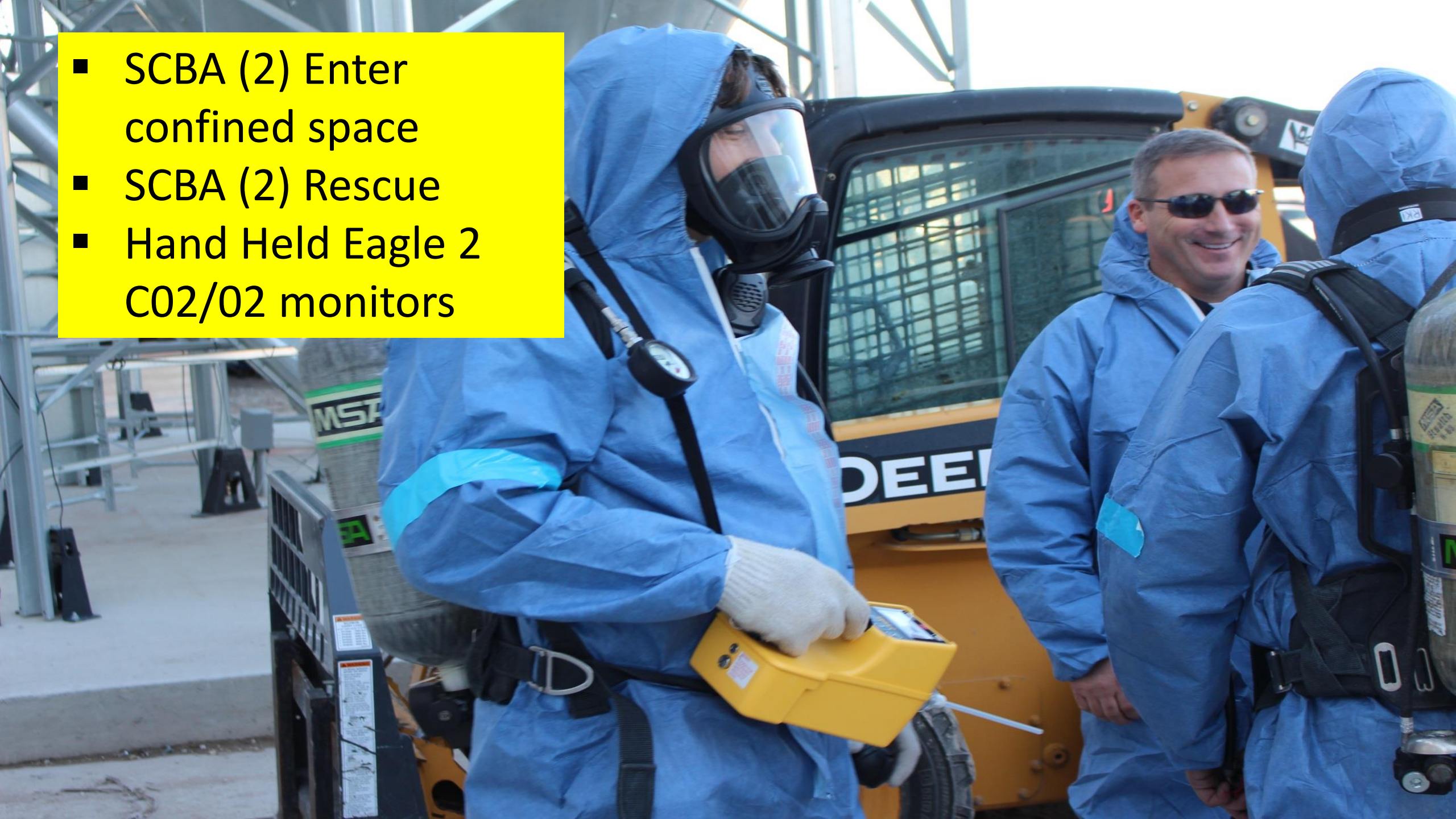
- Safety First
- Roll Call
- Communication
- Line of sight
- Buddy System
- Upwind/away

C02 Gassing

- Clear building
- Depopulation Lead-Safety roll call
- Communication check-radios
- Monitoring in place-high/low
- Depopulation Lead-signal for C02 vapor to charge system then change to C02 liquid
- Open to full flow rate
- Monitor for 20% C02-decrease flow rate- birds unconscious
- ~40% C02 concentration at high point~50 minutes-hold for 10 minutes
- 02 will approach single digits
- Temperatures at flash low points will approach 20 degrees F
- Avg. Temperature range 65-85 F

Gassing/Monitoring

- Recording
- Eagle 2 Monitor
- Monitor lines
- Gassing/safety chains
- Hoses to Dosing Manifolds

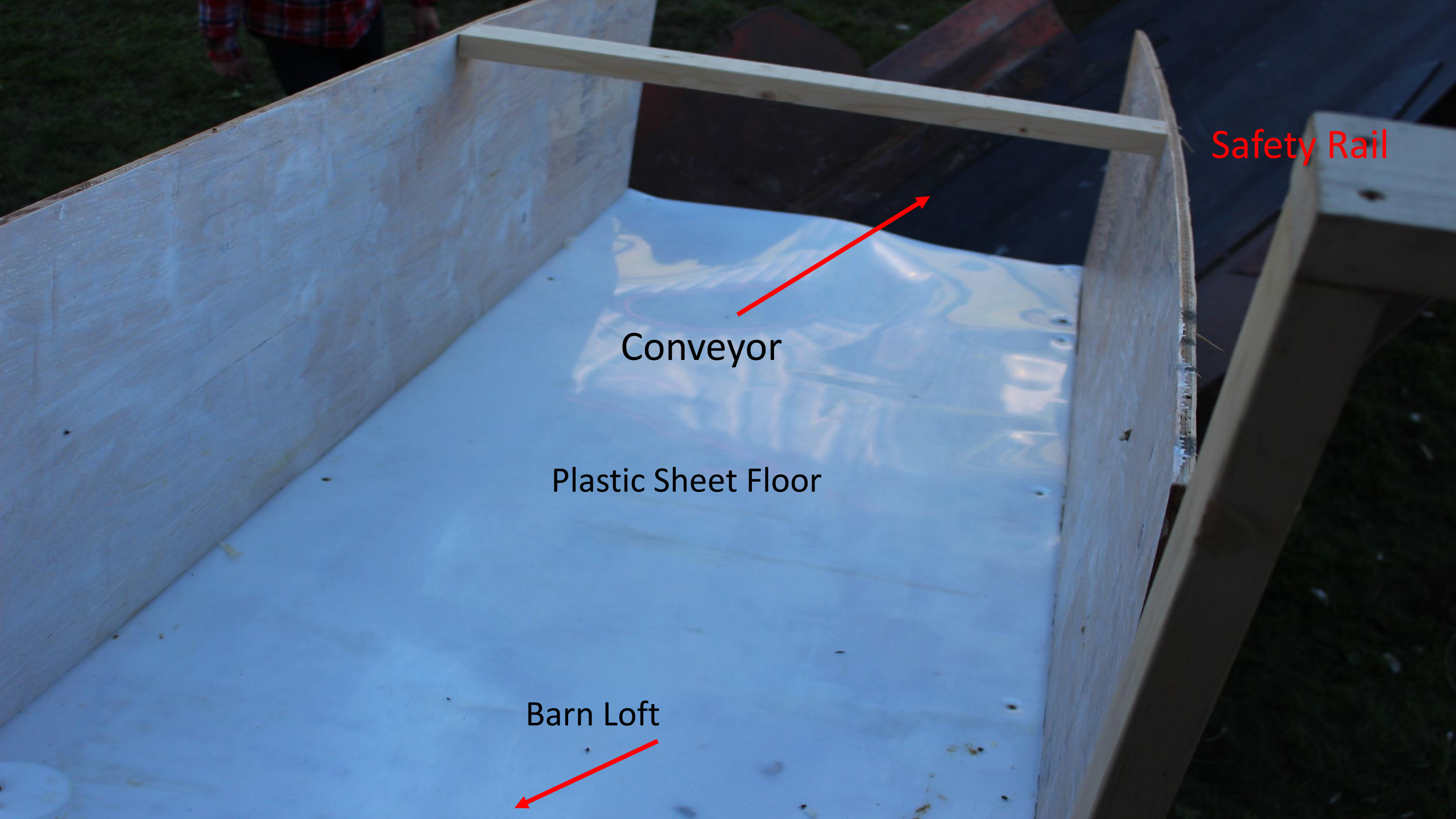


- SCBA (2) Enter confined space
- SCBA (2) Rescue
- Hand Held Eagle 2 C02/02 monitors

Venting

100% Mortality-note positions

- Two Teams of 15 working from middle to ends
- ~ 29 crew total-7 hours to remove 105,000 birds using C02 carts


Safety Rail
Conveyor
Plastic Sheet Floor
Barn Loft


50 ft. Conveyor powered by generator empties into rendering trailer
Chute from Barn loft
INEDIBLE


United Ren

Conventional Barns Comparison

Iowa: 640,900 ft3 ~74,000 lbs. of C02

Minnesota: 657,475 ft3 ~50,000 lbs. of C02

Best Practice: Seal Fans with precut poly & Pallet Bands


Best Practice-Identify & Label Fans
for Last to Seal and/or for Venting


Best Practice: Open inlet halfway to allow displaced air to escape when gassing
Note: limited Inlet opening in Ceiling

Resource comparison

Egg Layer:

- ***1 Depopulation Lead, 2 assistants***
- ***1 crew of (9) 3D contractors***
- ***1 Safety Officer***
- ***2 C02 tankers/drivers 1 C02 tanker flat barn***
- ***2 Units of CO2 WHG equipment***
- ***50,000 to 60,000 lbs. or 25-30 Tons of liquid CO2/ barn***

Flat Barn:

- ***1 Depopulation Lead, 2 assistants***
- ***1 crew of (9) 3D contractors***
- ***1 Safety Officer***
- ***1 C02 tankers/drivers***
- ***1 Unit of CO2 WHG equipment***
- ***7,000 to 12,000 lbs. or 3.5-6 Tons of liquid CO2/ barn***

~Egg Layer-Cost estimate per Bird

- ***Transport costs of log pack-$1500.00 total to and from,***
- ***2 C02 tankers- $32,212.00,***
- ***2 porta johns/eyewash station-$485.00 2 days***
- ***(9) 3D contractors-$1587.00***
- ***(3) VS Depopulation Leads travel costs $ 3,600.00***
- ***Total cost: $54,384***
- ***Cost per bird: 54,364 /105,000 birds= .52 or 52 cents/bird***
- ***Potentially, same resources could depopulate two large houses/day on same site = .26 or 26cents/bird***

~Flat Barn-Cost estimate per Bird

- ***Transport costs of log pack-$1500.00 total to and from,***
- ***1C02 tankers- $16,106.00,***
- ***2 porta-johns/eyewash station-$485.00 2 days***
- ***(9) 3D contractors-$1587.00***
- ***(3) VS Depopulation Leads travel costs $ 3,600.00***
- ***Total cost: $23,278.00***
- ***Cost per bird: 23,278 /6000 birds= $3.87/bird***
- ***Potentially, same resources could depopulate 4 flat barns/day on same site 23,278/24,000 = .96 cents/bird***

Metrics for Egg Layer C02 WHG

- ***2.5 hours for assessment, sealing of fans/doors, placement of monitoring lines and all components of the gassing unit-poly sheets for fans were precut and monitors were bump tested the night before to maximize time-allow for 3 hours of prep time if no previous site visit. Best practice: use complete team to position units & hoses first then divide up for sealing/placement of monitoring lines***

- ***25 minutes to reach 20% concentration of CO2 and 50 minutes to reach 40% concentration. Hold for 10 minutes-1 hour for gassing***

- ***1 hour for venting of house-remove fan covers on downwind side, turn on selected fans for venting, open roll doors and remove fan covers on upwind side. 2 SCBA equipped 3D contractors needed for venting downwind side and internal entry except for removal of fan covers on upwind side***

- ***2 hours for breakdown and C&D of equipment/repack into trailer***

- ***6.5 to 7 hours for Load out of 105,000 birds w/ 29 crew divided into 2 teams working from middle to each end . The load out crew found it easier to pull dead birds from the cages than live ones – less noise, less dust, less scratching and pecking***

Metrics of Flat Barn C02 Gassing

- 1.5 hours for assessment, positioning of distribution box, hoses, manifolds, monitoring equipment and sealing of fans/doors with poly-minimal
- 15-20 minutes to reach 20% concentration of C02 @ 3ft. when birds are considered unconscious
- 36 minutes to reach 40-45% concentration of C02 at highest level in house where birds are depopulated
- Estimate 7000 to 12, 000 lbs. of C02 needed to reach concentration in floor birds or breeder broiler birds per houses~400 ft. long x 40 ft. wide x 3 ft. height
- 1 hour to vent house and 2 hours for demobilization and C&D
- Temperature: 75 F H @ low next to manifold -22 F floor
- 2 hours to remove 6,000 birds with small crew & Bobcat for transport to rendering

Overview

- NVS Proof of Concept Completed in US November 2016-safe and effective in solid-large sided egg laying facilities and/or curtain sided flat barns
- NVS Log Pac, C02 Gassing SOP, C02 Gassing Checklist, PP Presentation completed-all draft
- National Veterinary Stockpile-Expansion Phase-Production & Placement in poultry dense regions- Fall 2016 Winter 2017- 8 Units current inventory NVS warehouse
- Pros-Clean, quick, humane, equipment is simple, procedure is simple, C02 is accepted method of depopulation by industry
- Cons-house preparation, availability of C02 & distance to refill, confined space (need SCBA) to clear house, high pressure connection from tanker to distribution box requires C02 provider to agree to connect-currently contracted with Praxair and working to gain acceptance from other C02 providers

Dr. Scott Beutelschies

Emergency Coordinator D6 CA/HI

Scott.A.Beutelschies@aphis.usda.gov

916-206-8143

Attachment 9

Whole House Gas SOP, Oct 2018

Whole House Gas SOP

10/05/2018

1. Assess each house for width, length, height, number of birds, & the logistical requirements needed to properly seal the house.
2. Calculate the estimated amount of C02 needed for the Volume of gassed space. Calculate Volume by W x L x Height (1 ft. above bird head) divided by 8.9 to obtain a reasonable estimate of C02. Compress birds to decrease length/width if mobile and possible.

3. Post the "Biosecurity/Do Not Enter" signs at every entrance to the house.

4. Inspect the perimeter of the house and seal up any areas where CO2 could leak out.

5. Position the CO2 truck within 20 ft. the front entrance of the house or a side door & connect the distribution manifold to the CO2 truck.

6. Station the two to four dosing manifolds inside the house:
    a. Decide where to install the false wall within the house. (Need to contact company-stocking density of birds, doors, structure for wall?)
    (After the location of the wall is determined, you can determine where to place the manifolds).
        i. Place one manifold within close proximity to the front entrance of the house. (About 1/3rd distance away from the front entrance).
        ii. Place the second manifold towards the back of the house. (About 2/3rd distance away from the front entrance).
        iii. Ensure each manifold is stationed horizontally in its stand. (By making this adjustment, the CO2 will flow out of each manifold tube about three feet from the ground).

iv. Verify that dosing manifolds are 25 ft. away from the monitoring locations

7. Connect one 25ft. hose line to each manifold.
    a. Depending on the distance between the distribution manifold and the dosing manifold, multiple sections of hose will be needed.
        i. Label or notate the “short” hose line (or the line closest to the CO2 truck).
        ii. Label or notate the “Long” hose line (or the line furthest from the CO2 truck).

8. Connect the CO2 monitors to four different sections of the house.
    a. Track and notate the CO2 & O2 levels in the house every five minutes. For those monitors with two lines, each line needs to be tracked and notated every five minutes.
        i. First unit stationed at the front entrance (The area between the false wall and the interior wall of the house).
        ii. Second unit 25ft away from the front entrance manifold.
            1. Monitor two separate lines at this station. Position the “High Line hose” 1ft. above the head of the bird and at the center of the house.
            2. Position the “Low Line hose” at 1 ft. and at the interior wall of the house.
        iii. Third unit 25ft away from the back entrance manifold.
            1. Monitor two separate lines at this station. Position the “High Line hose” 4ft from the ground and at the center of the house.
            2. Position the “Low Line hose” at 1 ft. and at the interior wall of the house.
        iv. Forth unit stationed between the false wall at the rear of the house and the interior rear wall.

9. Once the hose lines are connected to the manifolds and monitors are in place, perform a Quality Control (QC) check:
    a. For both manifolds and the hose lines connected to them. (Ensure each connection is tight & not cross threaded).
    b. Verify the hose lines connected to the Distribution manifold are properly tightened.
    c. Verify all personnel have vacated the house.
    d. Position two personnel…one at the back entrance and the other at the front entrance of the house, to prevent entry and maintain line of sight.

10. When all personnel are stationed accordingly, the "Whole House Gassing" procedure can begin.

11. Follow the steps below to start, monitor, and shut off the CO2:
    a. The CO2 truck driver has over sight with turning the gas off and on. You must request the vapor & CO2 be turned off and on.
    b. Open both gas lines completely at the distribution box.
    c. Request "vapor" be turned on and blown through the lines.
        i. This clears the lines of any moisture that could potentially cause issues with the entire procedure once the CO2 is flowing.
    d. Notate two minutes from the time the vapor starts to flow.
    e. Once those two minutes have past, request the CO2, (or "liquid") start to flow into the house.
    f. Once both lines have "liquid" flowing from them, check the flow of the manifolds by locating them from the outside of the house and listen to the CO2 flow.
        i. This aids in making sure the CO2 reaches the entire portion of the house evenly.
    g. While walking the length of the house, check for any leaks that need attention.
    h. Check for signs of life:
        i. Flapping, gobbling etc.

    ii. Monitor for signs of life the entire time the CO2 is flowing.

i. Continue to monitor the CO2% & O2 % from within the house every five minutes.

j. Once the CO2 reaches 20% and the O2 reaches 15-16%, turn back the “Short” hose down to ¼ turn.
    i. This restricts the flow of the CO2 and forces it to focus on flowing more forcefully out of the “long” hose.

k. Notate the CO2 poundage used located at the side of the CO2 truck throughout the entire procedure.
    i. The poundage used varies from house to house, but on average 4,000-4,500lbs are needed per house.

l. Once the CO2 reaches and maintains 40% or above, focus on the O2%.
    i. The O2% needs to drop below 10% and maintain that level for 10 minutes prior to shutting off the gas.
        1. On average, a 200ft house sectioned off will take 30-40 minutes to reach the desired percentages, while a 400ft house will take 40-45 minutes.
        2. This is all based around the number of birds in the house, the length partitioned off, and the ceiling height.

m. Once the desired Co2 & O2 percentages are reached and held for 10 minutes, the “Shut Off” procedure can begin:
    i. Request to shut off the “Liquid” and turn on “vapor”.
    ii. After shutting of the CO2, continue to monitor the CO2% & O2% levels within the house over the next 10 minutes.
    iii. Notate the total pounds of CO2 used per house.
    iv. Request to have the “vapor” shut off once two minutes have past.
    v. Leave the house sealed up for the next hour.
    vi. Have “Clean Harbor” or other personnel equipped to clear a house of CO2 levels after one hour has past.
    vii. Move onto the next house and start the protocol again.